STAFF SUMMARY FOR APRIL 26-27, 2017

17. NON-MARINE REGULATION PETITIONS AND NON-REGULATORY REQUESTS

Today's Item **Information ☐** **Action ☒**

This is a standing agenda item for FGC to act on regulation petitions and non-regulatory requests from the public that are non-marine in nature. For this meeting:

(A) Action on petitions for regulation change received at the Feb 2017 meeting.

(B) Action on non-regulatory requests received at the Feb 2017 meeting.

(C) Update on pending regulation petitions and non-regulatory requests referred to staff or DFW for review.

Summary of Previous/Future Actions

(A-B)

- FGC receipt of new petitions and requests — Feb 8-9, 2017; Rohnert Park
- **Today's FGC action on petitions and requests — Apr 26-27, 2017; Van Nuys**

(C)

- **Today's update and possible action on referrals — Apr 26-27, 2017; Van Nuys**

Background

FGC provides direction regarding requests from the public received by mail and email and during public forum at the previous FGC meeting. Public petitions for regulation change or requests for non-regulatory action follow a two-meeting cycle to ensure proper review and consideration.

Petitions or requests scheduled for consideration today were received or referred at the Feb 2017 meeting in one of three ways: (1) submitted by the comment deadline and published as tables in the meeting binder, (2) submitted by the late comment deadline and delivered at the meeting, or (3) received during public forum.

Exhibits A1 and B1 summarize the regulation petitions and non-regulatory requests received through the last meeting that are scheduled for FGC action today. The exhibits contain staff recommendations for each request.

(A) ***Petitions for regulation change.*** As of Oct 1, 2015,any request for FGC to adopt, amend, or repeal a regulation must be submitted on form FGC 1, "Petition to the California Fish and Game Commission for Regulation Change" (Section 662, Title 14). Petitions received at the previous meeting are scheduled for consideration at the next business meeting, unless the petition is rejected under 10-day staff review as prescribed in subsection 662(b).

Today, four non-marine regulation petitions received in Feb 2017 are scheduled for FGC action (See summary table in Exhibit A1 and individual petitions in exhibits A2-A5).

(B) ***Non-regulatory requests.*** Requests for non-regulatory action received at the previous meeting are scheduled for consideration today.

Two non-regulatory requests received in Feb 2017 are scheduled for action (see summary table Exhibit B1 and individual request in Exhibit B2).

(C) ***Pending regulation petitions and non-regulatory requests.*** This item is an opportunity for staff to provide a recommendation on items previously referred by FGC to DFW or FGC staff for review. FGC may act on any staff recommendations made today.

Today, there are recommendations for two pending regulation petitions:

1. *Petition #2015-008 (hunting of American badgers and gray fox).* In Apr 2016 FGC referred this petition (Exhibit C.1), requesting the repeal of hunting of American badger and gray fox, to the WRC Predator Policy Workgroup (PPWG) for evaluation and recommendation. PPWG completed its review and offers two options for FGC consideration.

   Option 1. The recommendation of the majority of PPWG members is to refer the American badger portion of the petition to DFW for evaluation and recommendation, and to deny the gray fox portion of the petition; or

   Option 2. The recommendation of the minority of the PPWG members is to refer the petition to DFW for the separate evaluation and recommendation for American badger and gray fox.

2. *Petition #2016-026 (jacketed frangible bullets):* In Feb 2017 FGC referred this petition, requesting the use of DRT's jacketed frangible bullets for big game hunting, to DFW for evaluation and recommendation. As of the completion of the meeting materials, DFW has not yet provided its evaluation, though is expected to provide a verbal update at the meeting.

Significant Public Comments

(A) ***Petition #2016-030 (American bullfrogs).*** A petition with 3212 signatures (see Exhibit 16.3) and an additional 103 comment letters asking FGC to add exotic bullfrogs and turtles to the restricted species list. In addition, FGC received an email containing supplemental information in support of the petition (Exhibit A6).

Petition #2016-031 (ferrets). Two emails in support of the petition, one from Assemblymember Todd Gloria (Exhibit A7) and the other from the petitioner which contains an "open letter to FGC" (Exhibit 8) and previously-provided survey results (due to its size, available from staff).

(C) ***Petition #2015-008 (American badgers and gray fox).*** The petitioner supports the minority PPWG recommendation to refer the petition to DFW for separate evaluation and recommendation (Exhibit C2).

Petition #2015-010 (Gray wolf). The petitioners address several points made at the Feb 2017 FGC meeting and request FGC commit to a rulemaking schedule for the petition (Exhibit C3). Two supporters of the petition (exhibits C4 and C5).

Petition #2015-009 (Trapping Fees). Two supporters of adjusting trapping fees to recover program costs consistent with this petition (exhibits C6 and C7).

Recommendation

(A-B) Adopt staff recommendations for regulation petitions and non-regulatory requests to (1) deny, (2) grant, or (3) refer to committee, DFW staff, or FGC staff for further evaluation or information gathering. See exhibits A1 and B1 for staff recommendations for each regulation petition and non-regulatory request.

(C) Adopt PPWG recommendation option 1 or option 2 for regulation petition #2015-008, and defer action on Petition #2016-026 to Jun 2017 to allow time for DFW to submit its evaluation and for FGC staff review of the evaluation and any recommendations.

Exhibits

A1. FGC table of non-marine petitions for regulation change received through Feb 9, 2017
A2. Petition #2016-030, received Dec 9, 2016
A3. Petition #2016-031, received Dec 5, 2016
A4. Petition #2016-032, received Dec 16, 2016
A5. Petition #2017-001 received Feb 2, 2017
A6. Email with supplemental information from Dr. Sarah Kupferberg and Dr. Andrea Adams concerning Petition #2016-030, received Apr 13, 2017
A7. Letter from Assemblymember Todd Gloria concerning Petition #2015-031, received Mar 29, 2017
A8. Letter from Pat Wright concerning Petition #2016-031, received Apr 6, 2017
B1. FGC table of non-marine non-regulatory requests received through Feb 9, 2017
B2. Email from Kevin Ward concerning mountain lion products, received Jan 17, 2017
C1. Petition #2015-008, received Dec 2, 2017
C2. Email from Susan Kirks concerning Petition #2015-008, received Apr 13, 2017
C3. Letter from Center for Biological Diversity and Project Coyote concerning Petition #2015-010, received Apr 13, 2017
C4. Email from Dr. Kelly Dunn concerning Petition #2015-010, received Apr 13, 2017
C5. Email from Pat Marriott concerning Petition #2015-010, received Apr 13, 2017
C6. Email from Dr. Kelly Dunn related to Petition #2015-009, received Apr 13, 2017
C7. Email from Edward Macan related to Petition #2015-009, received Feb 2, 2017

Motion/Direction

(A-C) Moved by _____ and seconded by _____ that the Commission *adopts* the staff recommendations for actions on February 2017 regulation petitions and non-regulatory requests, *adopts* Option _____ for the PPWG recommendation on Petition #2015-008, and *approves* the staff recommendation to schedule action on Petition #2016-026 for June 2017.

OR

Moved by _____ and seconded by _____ that the Commission *adopts* the staff recommendations for actions on February 2017 regulation petitions and non-regulatory requests, *adopts* Option _____ for the PPWG recommendation for Petition #2015-008, and *approves* the staff recommendation to schedule action on Petition #2016-026 for June 2017, except for item(s) _____ for which the action is _____.

CALIFORNIA FISH AND GAME COMMISSION
DECISION LIST FOR NON-MARINE REGULATION PETITIONS THROUGH FEB 9, 2017
Revised 04-11-2017

FGC - California Fish and Game Commission **DFW** - California Department of Fish and Wildlife **WRC** - Wildlife Resources Committee **MRC** - Marine Resources Committee

Grant: FGC is *willing to consider* the petition through a process **Deny:** FGC is *not willing to consider* the petition **Refer:** FGC *needs more information* before deciding whether to grant or deny the petition

Tracking No.	Date Received	Accept or Reject	Name of Petitioner	Subject of Request	Code or Title 14 Section Number	Short Description	Staff Recommendation	FGC Decision
2016-030	12/9/2016	A	Jennifer Loda Center for Biological Diversity, Save the Frogs!	American bullfrogs	671(c)(3), T14	Add American bullfrogs to the list of restricted species.	**Deny: Would require permit exemptions pursuant to Fish and Game Code Section 6881 that limit oversight and incur potentially significant administrative and enforcement costs.**	RECEIPT: 2/8-9/2017 **ACTION: Scheduled 4/26-27/2017**
2016-031	12/5/2016	A	Pat Wright	Ferrets	Section 2118, Fish & Game Code; 671, T14	Requests FGC issue permits for ferrets under certain circumstances.	**Deny: FGC has previously indicated that it will not authorize wild animals to be possessed as pets.**	RECEIPT: 2/8-9/2017 **ACTION: Scheduled 4/26-27/2017**
2016-032	12/16/2016	A	Paul Siebensohn	Striped bass	5.75, T14	Remove all size and limit restrictions on the take of striped bass.	**Deny: Inconsistent with existing FGC policy and potentially significant impacts that require further analysis. Possible options for striped bass management scheduled for discussion at the FGC/DFW Delta Fisheries Forum on May 24, 2017.**	RECEIPT: 2/8-9/2017 **ACTION: Scheduled 4/26-27/2017**
2017-001	2/2/2017	A	Sean Brady National Rifle Association, California Rifle and Pistol Association	Archery hunting	354(h), T14	Allow firearm possession while archery hunting.	**Refer: To DFW for evaluation and recommendation.**	RECEIPT: 2/8-9/2017 **ACTION: Scheduled 4/26-27/2017**

State of California – Fish and Game Commission
PETITION TO THE CALIFORNIA FISH AND GAME COMMISSION FOR REGULATION CHANGE
FGC 1 (NEW 10/23/14) Page 1 of 3

2016-030

Tracking Number: (~~Click here to enter text.~~)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
   Name of primary contact person: **Jennifer Loda, on behalf of Petitioners Center for Biological Diversity and Save the Frogs!**
   [redacted]

2. **Rulemaking Authority (Required) -** Reference to the statutory or constitutional authority of the Commission to take the action requested: **Fish and Game Code Sections 2118(i) and 2118(k)**

3. **Overview (Required) -** Summarize the proposed changes to regulations: **Amend 14 CCR 671(c)(3) to add bullfrogs (*Rana catesbeiana, Lithobates catebianus*) to the list of restricted species.**

4. **Rationale (Required) -** Describe the problem and the reason for the proposed change: **The American bullfrog is a non-native, invasive species that negatively impacts a wide variety of native wildlife in California. Bullfrogs act as both predators and competitors of California's native wildlife. They also act as a disease vector and have been implicated in the introduction and spread of ranaviruses and the amphibian chytrid fungus, which are considered to be the most significant infectious diseases contributing to global population declines of amphibians. The Commission recognized the threat of imported live American bullfrogs to California's native fish and wildlife in a declaration in 2010, which resulted in the Department of Fish and Wildlife imposing additional requirements on importation permits. The Department recently re-assessed the threats posed by live bullfrog imports, in light of the permit modifications, and presented a report to the Commission at its February 12, 2015 meeting. In its report, entitled "Implications of Importing American Bullfrog (*Lithobates catesbeianus* = *Rana catesbeiana*) into California," the Department explained that the threats were not diminished, and suggested that amphibian importation permits should be further limited or eliminated altogether to reduce the risks to native wildlife. The Commission is obligated to take actions within its power to conserve California's threatened and endangered species. Adding the American bullfrog to the list of restricted species is clearly**

within the capacity of the Commission and will help to reduce the risks that importation of live bullfrogs has on native fish and wildlife in California, including many species protected under the California Endangered Species Act.

SECTION II: Optional Information

5. **Date of Petition: 12/07/2016**

6. **Category of Proposed Change**
   - ☐ Sport Fishing
   - ☐ Commercial Fishing
   - ☐ Hunting
   - ☒ Other, please specify: Restricted Species

7. **The proposal is to:** (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)
   - ☒ Amend Title 14 Section(s):671(c)(3)
   - ☐ Add New Title 14 Section(s): Click here to enter text.
   - ☐ Repeal Title 14 Section(s): Click here to enter text.

8. **If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition** Click here to enter text.
   Or ☒ Not applicable.

9. **Effective date**: If applicable, identify the desired effective date of the regulation.
   If the proposed change requires immediate implementation, explain the nature of the emergency: Click here to enter text.

10. **Supporting documentation:** Identify and attach to the petition any information supporting the proposal including data, reports and other documents: **Petition to Add Bullfrogs to the List of Restricted Species. All papers referenced in the supporting petition will also be submitted to the Commission via cd**

11. **Economic or Fiscal Impacts:** Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: **Prohibition on importation of live bullfrogs may have some impact on the food market. However, allowance of frozen bullfrog importation, transportation, sales and possession will likely offset this minor economic impact. The vast majority of Californians do not participate in the purchase, sale or importation of American Bullfrogs.**

12. **Forms:** If applicable, list any forms to be created, amended or repealed:
    Click here to enter text.

SECTION 3: FGC Staff Only

Date received: Click here to enter text. 12/9/16

FGC staff action:

- ☒ Accept - complete
- ☐ Reject - incomplete
- ☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: 12/9/16

Meeting date for FGC consideration: April 26-27, 2017

FGC action:

- ☐ Denied by FGC
- ☐ Denied - same as petition _____
  Tracking Number
- ☐ Granted for consideration of regulation change

BEFORE THE CALIFORNIA FISH AND GAME COMMISSION

PETITION TO ADD BULLFROGS TO THE LIST OF RESTRICTED SPECIES

Photo by Carl D. Howe

CENTER FOR BIOLOGICAL DIVERSITY and SAVE THE FROGS!

December 7, 2016

I. NOTICE OF PETITION

Pursuant to Title 14, Section 662 of the California Code of Regulations ("CCR") (*Petitions for Regulation Change*), the Center for Biological Diversity ("the Center") and Save the Frogs! (collectively, "Petitioners") submit this petition to the California Fish and Game Commission ("the Commission") to amend Section 671(c)(3) of Title 14 of the CCR to add bullfrogs (*Rana catesbeiana, Lithobates catebianus*) to the list of restricted species to protect the native wildlife of this state. 14 CCR 662. Such a regulatory amendment would prevent new introductions of bullfrogs into the state, protecting against further damage to native wildlife. This non-native, invasive frog devastates native wildlife populations through disease spread and by consuming and competing with numerous species, including several that are listed under the federal Endangered Species Act ("ESA") and/or the California Endangered Species Act ("CESA"), as well as California Species of Special Concern.

A. LEGAL AUTHORITY

The Commission possesses the authority to make such amendments pursuant to Sections 2118, and 2120 of the California Fish and Game Code ("FGC").

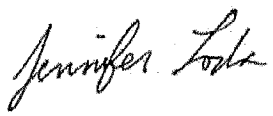
B. PETITIONERS

The Center for Biological Diversity is a non-profit, public interest environmental organization dedicated to the protection of species and their habitats through science, policy and environmental law. The Center has over 1.1 million members and online activists worldwide, including over 100,000 members and supporters in California.

Save the Frogs! is the world's leading amphibian conservation organization. Save the Frogs! works in California, across the USA, and around the world to prevent the extinction of amphibians, and to create a better planet for humans.

Authors: Jenny Loda, Center for Biological Diversity
Address: 1212 Broadway St, Suite 800, Oakland, CA 94612
Phone: (510) 844-7136
Email: jloda@biologicaldiversity.org

I hereby certify that, to the best of my knowledge, all statements made in this petition are true and complete.



Jenny Loda
Staff Attorney
Center for Biological Diversity
Submitted on behalf of Petitioners
Date submitted: December 7, 2016

II. INTRODUCTION

The bullfrog is widely recognized as one of the most destructive, invasive species in areas outside of its native range. Bullfrogs prey on and compete with, California's native wildlife. They can also play a role in the spread of novel wildlife diseases, including the amphibian chytrid fungus, which has devastated amphibian populations in California and throughout the world.

The Commission and the California Department of Fish and Wildlife ("the Department") have previously recognized the dangers that bullfrogs pose to California's wildlife and the potential for live bullfrog imports to contribute to this problem. In response, they have taken positive steps to limit the potential for new introductions associated with trade, by adding permit measures such as requiring that animals be euthanized before leaving retail premises. Unfortunately, those changes have not been sufficient to fully remove the threat of future bullfrog introductions into California linked to live imports. The Commission has the authority to regulate imports of wild animals and on previous occasions used this authority to add species to the Restricted Animal's List that were found to pose a threat to California's native wildlife.

In February, 2015, the Department presented the Commission with a comprehensive peer-reviewed paper on the risks of American bullfrogs to California's wildlife.[1] In this paper the Department found that importation of live American bullfrogs poses a significant threat to California's wildlife, and argued for the reduction or elimination of importation of live bullfrogs to reduce that threat. The Department concluded that a more comprehensive ban or reduction would provide the best benefit to our wildlife.

III. FACTUAL AND LEGAL BACKGROUND

A. The Commission's Authority to Act

It is California's policy that "the importation, transportation, and possession of wild animals shall be regulated . . . to protect the native wildlife and agricultural interest of this state against damage from the existence at large of certain wild animals."[2]

To enact this policy, the California Legislature gave the Commission, in cooperation with the Department of Food and Agriculture, the authority to adopt regulations governing "the entry, importation, possession, transportation, keeping, confinement, or release of any and all wild animals that will be or that have been imported into this state . . . "[3] This authority includes the power to designate additional species of wild animals as Restricted Animals when the species "is proven to be undesirable and a menace to native wildlife or the agricultural interests of the state."[4] As will be further explained below, the American bullfrog is a clear example of an undesirable species that is a menace to California's native wildlife, and the Commission should

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[1] California Department of Fish and Wildlife ("CDFW"). 2014. Implications of Importing American Bullfrog (*Lithobates catesbeianus* = *Rana catesbeiana*) into California.
[2] FGC § 2116.5 (Findings and Declarations)
[3] FGC § 2120(a)
[4] FGC § 2118(i)

use its power to restrict its importation by adding it to the Restricted Animals List in Section 671 of Title 14.

Consistent with these conservation mandates, the Commission has previously added a number of species to the Restricted Animals List at Section 671. For example, in 2007 the Commission adopted a regulatory change to add seven species and two genera to the Restricted Animals List.[5] The Commission found the animals to be non-native invasive species that "pose[d] a threat to native fish and wildlife populations through competition for food, predation, alteration of habitats and/or as potential sources of introducing diseases or parasites to native fish and wildlife."[6] In that instance several of the species, such as watersnakes and coqui frogs, were already present in California, but the Commission found their addition to the list to be warranted in order to control the spread of these species.

Petitioners' proposed regulatory amendment would afford comparable protections to the state's fish and wildlife populations from the American bullfrog, which is a non-native invasive species that poses a threat through competition for food, predation, and as a potential source of emerging and novel wildlife diseases.

B. Species Description

The American bullfrog (*Lithobates catesbeianus*) is a frog species native to the eastern United States, but was introduced to California about a century ago. This species has been introduced all over the world to over 40 countries, as well as areas outside of its native range in North America. Bullfrogs are included in the Global Invasive Species Database's list of "One Hundred of the World's Worst Invasive Alien Species."[7] In 1997 the European Union banned the importation of live North American bullfrogs due to their invasiveness.[8]

The Department's 2014 Report provides a thorough discussion of the bullfrog's biology and ecology and explains how these characteristics lead to its classification as an invasive species.[9] Bullfrogs negatively impact a wide variety of native wildlife in California and, in particular, are

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[5] Office of Administrative Law's Notice ID #Z07-0925-08; http://www.fgc.ca.gov/regulations/2007/#671 (Last Accessed October 13, 2016).

[6] State of California Fish and Game Commission. September 12, 2007. Initial Statement of Reasons for Regulatory Action, Amend Section 671, Title 14, California Code of Regulations Re: Importation, Transportation, and Possession of Live Restricted Species. *Available at:* http://www.fgc.ca.gov/regulations/2007/#671 (Last Accessed October 13, 2016).

[7] Global Invasive Species Database (2016). *Available at*: http://www.iucngisd.org/gisd/100_worst.php (Last Accessed Oct. 12, 2016).

[8] Scalera, R. and Zaghi, D., 2004. Alien species and nature conservation in the EU. The role of the LIFE program. Brussels, Belgium: European Commission.

[9] CDFW (2014) *supra* fn. 1; Kats, L.B. and R.P. Ferrer. 2003. Alien Predators and Amphibian Declines: Review of Two Decades of Science and the Transition to Conservation. Diversity and Distributions 9: 99-110.

implicated in the declines of amphibians.[10] Bullfrogs act as both predators and competitors of California's native wildlife, and can cause reproductive interference for other frog species. They also act as a disease vector and have been implicated in the introduction and spread of ranaviruses and the amphibian chytrid fungus (*Batrachochytrium dendrobatidis*, *Bd*), which are considered to be the most significant infectious diseases contributing to global population declines of amphibians.

i. Bullfrogs Prey on and Compete with Native Wildlife in California

Bullfrogs are voracious, opportunistic predators, consuming a wide variety of prey dominated by invertebrates and small vertebrates. While bullfrog tadpoles primarily eat algae, they are also known to prey on the eggs and tadpoles of other frogs. Bullfrogs have been documented to prey on species listed as threatened or endangered under both the California Endangered Species Act ("CESA") and the federal Endangered Species Act ("ESA"), including California tiger salamanders, giant garter snakes, and mountain yellow-legged frogs.[11] They also prey on numerous other species of fish, salamanders, frogs, toads, birds, bats, snakes, and turtles, including many that are listed as Species of Special Concern in California.[12]

This ability to consume a wide variety of prey, including vertebrates, was documented in California's Cache Creek Watershed.[13] An evaluation of stomach contents of 65 bullfrogs collected at 21 sites throughout the watershed found bullfrog consumption of a wide variety of invertebrate and vertebrate prey, including fish, birds, lizards, snakes, turtles, and frogs.[14] The stomach contents included two hatchling western pond turtles and two unidentified frogs likely to be foothill yellow-legged frogs, both species classified as Species of Special Concern in California and currently being reviewed for listing under the ESA.[15]

The voracious appetite of bullfrogs also makes them important competitors for food with native wildlife, especially with California's amphibians since they often share the same habitats.

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[10] Kats, L.B. and R.P. Ferrer. 2003. Alien Predators and Amphibian Declines: Review of Two Decades of Science and the Transition to Conservation. Diversity and Distributions 9: 99-110; Jennings, M. R. 1996. Status of amphibians. Pages 921–944 in Sierra Nevada ecosystem project: final report to Congress, volume 2, assessments and scientific basis for management options. University of California, Centers for Water and Wildland Resources, Davis, California, USA.

[11] 69 Fed. Reg. 47212, 47233-34 (August 4, 2004); Wylie, G. D., Casazza, M. L., & Carpenter, M. (2003). Diet of bullfrogs in relation to predation on giant garter snakes at Colusa National Wildlife Refuge. California Fish and Game, 89(3), 139-145; 79 Fed. Reg. 24256, 24273 (April 29, 2014)..

[12] Thomson, R. C., Wright, A. N., & Shaffer, H. B. (2016). California Amphibian and Reptile Species of Special Concern University of California Press.

[13] Hothem, R. L., Meckstroth, A. M., Wegner, K. E., Jennings, M. R., & Crayon, J. J. 2009. Diets of three species of anurans from the Cache Creek Watershed, California, USA. Journal of Herpetology, 43(2), 275-283.

[14] *Id.*

[15] *Id.*; Thomson et al. (2016). *supra* fn.12; U.S. Fish and Wildlife Service ("USFWS"), ECOS Environmental Conservation Online System. *Available at*: http://ecos.fws.gov/ecp/ (Last Accessed Nov. 2, 2016).

Bullfrogs are a strong competitor with multiple life stages of the California red-legged frog.[16] Research indicates that bullfrogs may have an additional advantage of being able to outcompete other species of amphibians where fish are present because bullfrogs are unpalatable to fish, unlike most native amphibians.[17]

The presence of bullfrogs can also lead to reproductive interference with other frogs and these interactions may reduce the reproductive output of California's native frogs. For example, interspecific mating has been observed between male foothill yellow-legged frogs and female bullfrogs.[18]

ii. Bullfrogs Aid in the Introduction and Spread of Diseases Harming Native Wildlife

Emerging infectious diseases of wildlife pose a major threat to global biodiversity.[19] The global movement of plants and animals is a well-recognized mechanism for the introduction of pathogens into new regions.[20] International trade of wildlife can contribute to the introduction and spread of emerging and novel wildlife diseases, especially when the wildlife being traded are highly invasive species like bullfrogs.

Bullfrogs are a known carrier of the chytrid fungus *Batrachochytrium dendrobatidis* (Bd), which causes the disease chytridiomycosis. Bullfrogs are highly resistant to the disease, exhibiting no clinical signs when infected with the fungus.[21] In a recent study examining the relationships between invasive alien species and threatened vertebrates, Bd was identified as the invasive alien species that threatens the greatest number of vertebrates.[22] Chytridiomycosis is a contributor to the threatened status of almost 400 amphibian species worldwide and causes species extinctions, mass mortality events, and precipitous and persistent population declines.[23] The disease

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[16] Thomson et al. (2016) *supra* fn. 12.
[17] 79 Fed. Reg. 24264 (April 29, 2014).
[18] Lind, A. 2003. The Distribution and Habitat of Foothill Yellow-legged Frogs (*Rana boylii*) on National Forests in Southern Sierra Nevada Mountains of California. Report to the FHR Program of Region 5 of the USDA Forest Service. pp. 1-31.
[19] Ip, H. S., Lorch, J. M., & Blehert, D. S. 2016. Detection of spring viraemia of carp virus in imported amphibians reveals an unanticipated foreign animal disease threat. Emerging Microbes & Infections 5(9), e97.
[20] *Id.*
[21] Daszak, P, Strieby, A., Cunningham, A.A., Longcore, J.E., Brown, C., and D. Porter. 2004. Experimental evidence that the bullfrog (*Rana catesbeiana*) is a potential carrier of chytridiomycosis, an emerging infectious disease of amphibians. Herpetological Journal 14, 201-207.
[22] Bellard, C., Genovesi, P., and J.M. Jeschke. 2016. Global patterns in threats to vertebrates by biological invasions. *Proc. R. Soc. B* 283: 20152454.
[23] Lips, K.R. 2016. Overview of chytrid emergence and impacts on amphibians. Phil. Trans. R. Soc. B. 371: 20150462. *Available at* http://dx.doi.org/10.1098/rstb.2015.0465 (Last Accessed Nov. 2, 2016).

negatively impacts California's native amphibians, and played a major role in the declines of the Sierra Nevada yellow-legged frog, the mountain yellow-legged frog, and the Yosemite toad.[24]

The African clawed frog (*Xenopus laevis*) is also implicated as having played a role in the spread of Bd, as the earliest identified Bd infection was of this species and clawed frogs appear to be resistant to the onset of disease.[25] Early speculation was that the widespread distribution of this species in the 1940s and 1950s for human pregnancy testing disseminated the pathogen to differing regions of the world; however, African clawed frog distributions do not always overlap with Bd outbreaks so additional hosts, such as bullfrogs must also play a role in Bd's spread.[26] The African clawed frog does not currently present a major threat for the introduction of new pathogens into California because imports of this species are already restricted, as all frogs in the genus *Xenopus* are included in the Restricted Animal List.[27]

Ranaviruses are also classified as emerging pathogens, because their geographic distribution and host range appear to be expanding.[28] Ranaviruses are known to cause disease in amphibians, fish, and reptiles and have the potential to cause population declines and extinctions.[29] Ranaviruses may be a particularly significant threat to host species that are geographically isolated or exist at low abundance,[30] and California is home to numerous species of amphibians, fish, and reptiles that fall into these categories. Because ranaviruses can be transmitted between these different taxonomic classes of vertebrates, introductions of ranaviruses by imported bullfrogs can impact fish and reptiles, as well as amphibians.[31] Ranaviruses are frequently moved in the regional and international trade of animals.[32]

Commercial trade appears to play a major role in the spread of Bd and ranaviruses.[33] Bd and ranaviruses have been detected at bullfrog farms in Asia and South America.[34] In a study of newly

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[24] 79 Fed. Reg. 24256, 24274-24275, 24296 (April 29, 2014).

[25] Schloegel LM; Picco AM; Kilpatrick AM; Davies AJ; Hyatt AD; Daszak P. 2009. Magnitude of the US trade in amphibians and presence of *Batrachochytrium dendrobatidis* and ranavirus infection in imported North American bullfrogs (*Rana catesbeiana*). Biological Conservation 142:1420-1426.

[26] *Id.*

[27] Title 14 §671(c)(3)(B)

[28] Duffus, A.J., Waltzek, T.B., Stöhr, A.C., Allender, M.C., Gotesman, M., Whittington, R.J., Hick, P., Hines, M.K. and R.E. Marschang. 2015. Distribution and host range of ranaviruses. In *Ranaviruses*, pp. 9-57. Springer International Publishing.

[29] *Id.*

[30] *Id.*

[31] *Id.*

[32] *Id.*

[33] Schloegel, L.M., Toledo, L.F., Longcore, J.E., Greenspan, S.E., Vieira, C.A., Lee, M., Zhao, S., Wangen, C., Ferreira, C., Hipolito, M. and Davies, A.J., 2012. Novel, panzootic and hybrid genotypes of amphibian chytridiomycosis associated with the bullfrog trade. Molecular Ecology, 21(21), pp.5162-5177; Schloegel et al. (2009) *supra* fn. 25; Picco AM, Collins JP. 2008. Amphibian commerce as a likely source of pathogen pollution. Conservation Biology 22(6):1582-89.

imported bullfrogs in Los Angeles, New York, and San Francisco, researchers identified a high prevalence of Bd infections, with a presence of Bd on 62% of samples (306/493) and an infection prevalence of 8.5% (50/588) for ranaviruses.[35] In an additional study of 47 bullfrogs purchased from 13 shops in seven U.S. cities, 70% of the shops sold bullfrogs carrying infections with Bd, and 41% of the bullfrogs tested positive for Bd.[36]

While the importation of live bullfrogs may not greatly increase the geographic distribution of Bd and ranaviruses in California that are already present in the state, it may aid in the introduction of new strains of these pathogens.[37] Recent studies of Bd have revealed that the genetic diversity of Bd is much greater than previously realized, and there are multiple strains of the fungus found throughout the world, with some strains being more virulent than others.[38] Bullfrogs in U.S. markets are infected with a large diversity of Bd genotypes, and thus bullfrog invasions are likely to have facilitated intercontinental gene flow of Bd.[39]

There is still much that is unknown about additional pathogens that may be spread through the trade in wildlife. Chytrid fungus and ranaviruses are two currently recognized types of pathogens carried in the live bullfrog trade, but more are clearly possible. A recent study found that salamanders imported into the U.S. from China tested positive to spring viraemia of carp virus ("SVCV"), a pathogen not previously known to infect amphibians.[40] SVCV is a rhabdovirus pathogen of cyprinid fish that is considered an economically important pathogen impacting the commercial aquaculture industry.[41] This provides just one recent example of additional pathogens that may be spread into California through imports of live bullfrogs.

C. Current Regulation of Live Bullfrogs is Inadequate

Approximately two million live bullfrogs are currently imported into California each year, which are primarily sold in food markets.[42] These bullfrogs pose a threat to California's wildlife, for the reasons stated above, through the potential for the accidental or intentional release of imports. The Department acknowledged in its 2014 report that bullfrogs are likely to continue to spread

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[34] Mazzoni, R., A. Jose de Mesquita, and M.H.B. Catroxo. 2009. Mass mortality associated with a frog virus 3-like ranavirus infection in farmed tadpoles *Rana catesbeiana* from Brazil. Diseases of Aquatic Organisms 88(3):181-191; Schloegel et al. (2009) *supra* fn. 25; Mazzoni R, Cunningham A.A., Daszak P., Apolo A., Perdomo E., and G. Speranza. 2003. Emerging pathogen of wild amphibians in frogs (*Rana catesbiana*) farmed for international trade. Emerging Infectious Diseases 9(8):995-8.

[35] Schloegel et al. (2009) *supra* fn. 25.

[36] Schloegel et al. (2012) *supra* fn.33.

[37] Schloegel et al. (2009) *supra* fn. 25.

[38] Schloegel et al. (2012) *supra* fn.33.

[39] *Id.*

[40] Ip, H. S., Lorch, J. M., & Blehert, D. S. 2016. Detection of spring viraemia of carp virus in imported amphibians reveals an unanticipated foreign animal disease threat. Emerging Microbes & Infections 5(9), e97.

[41] *Id.*

[42] CDFW (2014) *supra* fn. 1.

within California, likely via three primary pathways.[43] Besides the dispersal and spread of existing bullfrog populations, one of the recognized pathways is via "new introduction events associated with live bullfrog importation and trade."[44] Another pathway recognized by the Department is via "new introduction events from ethically motivated releases of captive frogs,"[45] which may rely on live bullfrog markets to provide a source for frogs to be released.

In 2010 the Commission recognized this problem and declared "[t]he importation of non-native turtles and frogs poses threats not only to the State's native turtles and frogs, but also to the native source populations of the imported turtles and frogs."[46] The Commission further adopted a policy that the "Department of Fish and Game shall cease issuing importation permits for any live non-native turtles or frogs."[47]

Rather than cease issuing these importation permits, in response to the Commission's new policy the Department amended its own policies with additional requirements for the permits, including a requirement that all animals sold be euthanized before leaving the retail premises. However, the Department concluded in its 2014 report that these amendments have not been effective, as they have accumulated evidence of numerous violations of these new requirements.[48] The Department argued that the severity of the risks of bullfrogs to native wildlife is positively correlated to the number of live bullfrogs imported into California.[49] As a result of its findings, the Department argues in its report that "further limiting or eliminating the issuance of amphibian importation permit is a reasonable alternative to current policy."[50]

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[43] *Id.*
[44] *Id.*
[45] *Id.*
[46] "The Fish and Game Commission declares that:
1. The Fish and Game Commission and the Department of Fish and Game have been charged by the Legislature to protect and wisely manage the State's living natural resources and the habitats upon which they depend.
2. The importation of non-native turtles and frogs poses threats not only to the State's native turtles and frogs, but also to the native source populations of the imported turtles and frogs.
3. These threats include, but are not limited to: disease, hybridization, competition, and predation.
Therefore, it is the policy of the Fish and Game Commission that the Department of Fish and Game shall cease issuing importation permits for any live non-native turtles or frogs pursuant to Section 236, Title 14, CCR.
(Adopted: 4/8/2010)." California Fish and Game Commission. Miscellaneous Policies: Non-Native Turtles and Frogs. *Available at* http://www.fgc.ca.gov/policy/p4misc.aspx (Last Accessed Oct. 13, 2016).
[47] *Id.*
[48] CDFW (2014) *supra* fn.1.
[49] *Id.* at 11
[50] *Id.* at 12

IV. PROPOSED REGULATION AMENDMENT

Petitioners request the Commission adopt the following amendments to add American bullfrogs to the list of Restricted Live Wild Animals (additions shown in *redline italics*):

Title 14 §671. Importation, Transportation and Possession of Live Restricted Animals.

(c) Restricted species include:

(3) Class Amphibia -Frogs, Toads, Salamanders

(A) Family Bufonidae -Toads: Bufo marinus, Bufo paracnemis, Bufo horribilis (Giant toad or marine toad group) and all other large toads from Mexico and Central and South America-(D).

(B) Family Pipidae -Tongueless Toads: 1. Genus Xenopus (Clawed frog)-(D).

(C) Family Ambystomatidae-Mole Salamanders: 1. Genus Ambystoma (tiger salamanders) (D).

(D) Family Leptodactylidae -Neotropical Frogs: 1. Eleutherodactylus coqui - Common Coqui or Coqui frog

(E). Family Ranidae - True Frogs : 1. Rana catesbeiana (Lithobates catesbeianus) - American Bullfrog (D).

V. POLICY AND LEGAL JUSTIFICATION FOR PROPOSED REGULATION AMENDMENTS

A. The Commission is Legally Required to Advance Recovery of Species Listed in the California Endangered Species Act by Addressing Threats Such as Bullfrogs

The California Endangered Species Act ("CESA") requires the Commission to utilize its authority to carry out the purposes of the Act. The rulemaking requested under this petition is within the Commission's authority to implement and serves the purpose of CESA in reducing the detrimental impacts of bullfrogs to threatened and endangered species.

Specifically, when a species is listed as threatened or endangered pursuant to CESA, affirmative mandates come into force. CESA § 2055 requires that all state commissions and agencies "conserve endangered species and threatened species" and "utilize their authority in furtherance of the purposes" of CESA. CESA further defines "conserve" to mean "to use . . . *all methods and procedures which are necessary* to bring any endangered species or threatened species to the point at which the measures provided pursuant to this chapter are no longer necessary . . ."[51]

[51] CESA § 2061, *emphasis added.*

Further, CESA § 2052 declares that "it is the policy of the state to conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat."

Bullfrogs negatively impact the state-threatened California tiger salamander, giant garter snake, and Sierra Nevada yellow-legged frog.[52] They also impact mountain yellow-legged frogs, which are listed as state-endangered as three separate populations.[53] All of these species are also protected under the federal ESA.[54]

Bullfrogs prey on and compete with the federal and state protected California tiger salamander and are considered a threat to this species' recovery.[55] Tiger salamanders are also threatened by ranaviruses which may be spread by bullfrogs, as explained above.[56] An overall pattern of decline of this species is seen in areas where bullfrogs and other invasive species are present.[57] Bullfrogs and California tiger salamanders tend not to co-occur in the same wetlands and bullfrogs have eliminated some California tiger salamander populations.[58]

Bullfrogs are also recognized as predators of the giant garter snake.[59] An examination of bullfrog stomach contents at the Colusa National Wildlife Refuge in Colusa County showed neonate giant garter snakes in three of the 99 bullfrogs examined.[60] The authors estimated the total annual predation of bullfrogs to be about 22% of giant garter snake neonate production.[61]

Predation by bullfrogs and introduced fishes, and the chytrid fungus (Bd) and other pathogens are two of the primary driving forces leading to population declines in the mountain yellow-legged frog complex.[62] Predation by bullfrogs is considered to be an ongoing, significant threat

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[52] 69 Fed. Reg. 47212, 47233-34 (August 4, 2004); U.S. Fish and Wildlife Service ("USFWS"). 2012. Giant Garter Snake (*Thamnophis gigas*) 5-Year Review: Summary and Evaluation. *Available at*: http://ecos.fws.gov/ecp0/profile/speciesProfile?sId=4482 (Last Accessed Oct. 19, 2016); 79 Fed. Reg. 24256, 24273 (April 29, 2014).

[53] 79 Fed. Reg. at 24264 *supra* fn. 52.

[54] USFWS- ECOS *supra* fn. 15.

[55] 69 Fed. Reg. 47212, 47233-34 (August 4, 2004); U.S. Fish and Wildlife Service ("USFWS"). 2016. Recovery Plan for the Santa Rosa Plain: Blennosperma bakeri (Sonoma sunshine); Lasthenia burkei (Burke's goldfields); Limnanthes vinculans (Sebastopol meadowfoam); California Tiger Salamander Sonoma County Distinct Population Segment (Ambystoma californiense). U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California. vi + 128 pp.

[56] 69 Fed. Reg. 47212, 47233 (August 4, 2004).

[57] *Id.*

[58] USFWS (2016) *supra* fn. 55; USFWS. 2014. Central California tiger salamander 5-Year Review. *Available at*: http://ecos.fws.gov/ecp0/profile/speciesProfile?sId=2076 (Last Accessed November 4, 2016).

[59] USFWS (2012) *supra* fn. 52.; Wylie et al. (2003) *supra* fn. 11.

[60] Wylie et al (2003) *supra* fn. 11.

[61] *Id.*

[62] 79 Fed. Reg. 24256, 24275 (April 29, 2014).

to the Sierra Nevada yellow-legged frog and the mountain yellow-legged frog.[63] In its final listing rule for the mountain yellow-legged frog, the USFWS noted that "bullfrog predation and competition is expected to have population-level effects where bullfrog populations occupy the same areas as extant mountain yellow-legged frog populations."[64] At present the impact of bullfrogs on Sierra Nevada and mountain yellow-legged frogs is limited to the lower elevations where they co-occur, but bullfrogs may present more of a future threat to these native frogs if they are able to expand their elevational range as a result of climate change.[65]

B. The Commission Should Act to Protect California Species of Special Concern

The Commission's policy is to "[p]rotect and preserve all native species of fishes, amphibians, reptiles, birds, mammals, invertebrates and plants, and their habitats, threatened with extinction; or those experiencing a significant decline which, if not halted, would lead to a threatened or endangered designation."[66] This inherently includes Species of Special Concern, which are administratively designated by the Department to help preclude the need to list additional species by achieving conservation and recovery before they meet CESA criteria for listing as threatened or endangered.[67]

In a recent synthesis of the conservation risks faced by California amphibians and reptiles that qualify as Species of Special Concern ("SSC"), 16 of the 45 species were classified as Priority I, those of greatest concern.[68] Bullfrogs prey on and/or compete with 10 of these 16 Priority I species.[69] They also prey on and/or compete with other SSC, such as the northern red-legged frog.[70]

Among the 10 Priority I SSC affected by bullfrogs, the California red-legged frog, arroyo toad, and Oregon spotted frog are also federally-listed under the ESA; and the foothill yellow-legged frog, western pond turtle, and western spadefoot are currently being considered for ESA protection.[71] For example, bullfrogs are a strong competitor with, and predator on, multiple life stages of California red-legged frogs resulting in a strong overall negative impact on this federally-threatened species.[72] Although the federally-endangered arroyo toad is primarily

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[63] *Id.* at 24275.
[64] *Id.* at 24273.
[65] *Id.* at 24273-24274.
[66] California Fish and Game Commission. Miscellaneous Policies: Endangered and Threatened Species. *Available at*: http://www.fgc.ca.gov/policy/p4misc.aspx (Last Accessed Oct. 13, 2016).
[67] Thomson et al. (2016) at 4-5 *supra* fn. 12.
[68] *Id.* at 3
[69] *Id.* at 68, 91, 104, 110, 116, 122, 134, 294, 302, 308. These Priority I SSC include arroyo toad, foothill yellow-legged frog, California red-legged frog, northern leopard frog, Oregon spotted frog, lowland leopard frog, western spadefoot, common garter snake (southern populations), southern western pond turtle, and Sonora mud turtle.
[70] *Id.* at 81-82.
[71] USFWS - ECOS *supra* fn. 15.
[72] Thomson et al. (2016) at 104 *supra* fn. 12.

threatened by the loss and degradation of their habitat, declines are occurring in areas without these threats, largely due to introduced predators like bullfrogs.[73]

Foothill yellow-legged frogs are rare or absent in habitats where bullfrogs are present, due to competition between tadpoles of the two species, and predation of foothill yellow-legged frogs by metamorphosed bullfrogs.[74] In a study of bullfrog invasion in a northern California river system, foothill yellow-legged frogs were almost an order of magnitude less abundant in stream reaches where bullfrogs were well established.[75] In a follow-up artificial experiment bullfrog tadpoles caused a 48% reduction in survivorship of foothill-yellow legged frogs.[76]

For a number of these species, the management recommendations made in the recent Department publication on amphibian and reptile SSC included the need to remove bullfrogs and to protect against the further introduction of bullfrogs into their habitats.[77] The requested regulatory change will contribute to this effort by reducing the possibility of bullfrogs being re-introduced into areas where there are management efforts to remove them, and preventing bullfrog introductions into new areas.

VI. CONCLUSION

As the Commission has recognized, American bullfrogs pose a threat to California's native fish and wildlife, as they are strong predators and competitors of native species. Bullfrogs are implicated in the introduction and spread of deadly pathogens like chytrid fungus and ranaviruses, and future bullfrog imports may facilitate the introduction of additional emerging and novel wildlife disease These risks are especially problematic for rare animals like those protected under the federal Endangered Species Act and the California Endangered Species Act, and those classified as Species of Special Concern in California. To conserve native wildlife, as the law requires, the Commission should ban the importation of live American bullfrogs by adding this species to the list of restricted animals.

Respectfully submitted on behalf of Petitioners,

Jenny Loda
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Center for Biological Diversity
1212 Broadway Street, Suite 800
Oakland, California 94612
Phone: (510) 844-7136
jloda@biologicaldiversity.org

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[73] *Id.* at 64-68.
[74] *Id.* at 91.
[75] Kupferberg, S. J. 1997. Bullfrog (*Rana catesbeiana*) invasion of a California river: the role of larval competition. *Ecology*, *78*(6), 1736-1751.
[76] *Id.*
[77] *Eg.* Thomson et al. (2016) at 68, 92, 105, 117, 303.

State of California – Fish and Game Commission
PETITION TO THE CALIFORNIA FISH AND GAME COMMISSION FOR REGULATION CHANGE
FGC 1 (NEW 10/23/14) Page 1 of 3

Tracking Number: 2016-031 (Click here to enter text.)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
Name of primary contact person: Pat Wright
[redacted]

2. **Rulemaking Authority (Required)** - Reference to the statutory or constitutional authority of the Commission to take the action requested: **2118.** It is unlawful to import, transport, possess, or release alive into this state, except under a revocable, nontransferable permit as provided in this chapter and the regulations pertaining thereto, any wild animal of the following species: Mammals of the orders Primates, Edentata, Dermoptera, Monotremata, Pholidota, Tubulidentata, Proboscidea, Perissodactyla, Hyracoidea, Sirenia and Carnivora are restricted for the welfare of the animals, except animals of the families Viverridae and Mustelidae in the order Carnivora are restricted because suchanimals are undesirable and a menace to native wildlife, the agricultural interests of the state, or to the public health or safety.

3. **Overview (Required)** - Summarize the proposed changes to regulations: We are requesting the Fish and Game Commission issue permits to for ferrets under certain circumstances:
Only sterilized ferrets
Ferrets must be current on rabies vaccination
$100 or more cost per ferret per permit

4. **Rationale (Required)** - Describe the problem and the reason for the proposed change: Ferrets are already in California in large numbers and this is an issue that won't go away. This would allow dedicated ferret owners to come out of the closet and for the Fish and Game Commission to continue jurisdiction over domestic ferrets.

SECTION II: Optional Information

5. Date of Petition: December 3rd, 2016

6. Category of Proposed Change

☐ Sport Fishing
☐ Commercial Fishing
☐ Hunting
☒ Other, please specify: non marine animals

7. The proposal is to: (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)

☐ Amend Title 14 Section(s):Click here to enter text.
☐ Add New Title 14 Section(s): Click here to enter text.
☐ Repeal Title 14 Section(s): Click here to enter text.

8. If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition 2016-008
Or ☐ Not applicable.

9. Effective date: If applicable, identify the desired effective date of the regulation.
If the proposed change requires immediate implementation, explain the nature of the emergency: Click here to enter text.

10. Supporting documentation: Identify and attach to the petition any information supporting the proposal including data, reports and other documents: Documents have already been submitted for the previoius petition 2016-008

11. Economic or Fiscal Impacts: Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: Charge a fee necessary to cover the cost of issuing permits.

12. Forms: If applicable, list any forms to be created, amended or repealed:

Click here to enter text.

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION
2016 DEC -5 AM 10: 15

SECTION 3: FGC Staff Only

Date received: Click here to enter text.

FGC staff action:

☒ Accept - complete
☐ Reject - incomplete
☐ Reject - outside scope of FGC authority

Date petitioner was notified of receipt of petition and pending action: Dec 19, 2016

Meeting date for FGC consideration: April 26-27, 2017

FGC action:

- ☐ Denied by FGC
- ☐ Denied - same as petition _____
  Tracking Number
- ☐ Granted for consideration of regulation change

State of California – Fish and Game Commission
PETITION TO THE CALIFORNIA FISH AND GAME COMMISSION FOR REGULATION CHANGE
FGC 1 (NEW 10/23/14) Page 1 of 3

Tracking Number: 2016-032 ~~(Click here to enter text.)~~

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
Name of primary contact person: Paul Siebensohn
[redacted]

2. **Rulemaking Authority (Required)** - Reference to the statutory or constitutional authority of the Commission to take the action requested: Title 14 **§ 5.75. Striped Bass.** (a) Open season: All year except for closures listed in special regulations. (b) Limit: Two, except in waters listed in (d) below. (c) Minimum size: 18 inches total length except in waters listed in (d) below. (d) Exceptions: (1) In the Colorado River District, the Southern District (except Lake Elsinore), and New Hogan, San Antonio and Santa Margarita lakes. (A) Limit: Ten. (B) Minimum size: No size limit. (2) Lake Elsinore has the limit and minimum size shown in (b) and (c) above. (e) For the purpose of these regulations, any striped bass hybrid with white bass is considered to be striped bass. Note: Authority cited: Sections 200, 202, 205 and 215, Fish and Game Code. Reference: Sections 200, 202, 205 and 206, Fish and Game Code.

3. **Overview (Required)** - Summarize the proposed changes to regulations: Remove all size and limit restrictions on Striped Bass (*Morone saxatilis*)

4. **Rationale (Required)** - Describe the problem and the reason for the proposed change: They are a non-native species which are impacting endangered native species, particularly the Delta Smelt (*Hypomesus transpacificus*), as well migrating members of the Salmonidae family of fish. I have seen multiple times how striped bass hoard and devour bait balls of migrating minnows in the delta and have found them in the digestive system of the Striped bass when cleaning them. I do not see there would be any negative financial impacts to making this change, but possible increase in the interest in fishing and more licenses possibly sold. As a fishing license doesn't require a Striped Bass stamp anymore CDFW should not loose any money as a result of this change. As salmon are commercially fished, allowing

more Salmon fry to reach the ocean should help in the increase of their numbers and therefore the catch for commercial fishermen as well.

SECTION II: Optional Information

5. Date of Petition: 12/13/2016

6. Category of Proposed Change

☒ Sport Fishing
☐ Commercial Fishing
☐ Hunting
☐ Other, please specify: Click here to enter text.

7. The proposal is to: (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)

☒ Amend Title 14 Section(s):Click here to enter text.
☐ Add New Title 14 Section(s): Click here to enter text.
☐ Repeal Title 14 Section(s): Click here to enter text.

8. If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition Click here to enter text.
Or ☒ Not applicable.

9. Effective date: If applicable, identify the desired effective date of the regulation.
If the proposed change requires immediate implementation, explain the nature of the emergency: As Soon As Practical

10. Supporting documentation: Identify and attach to the petition any information supporting the proposal including data, reports and other documents: Click here to enter text.

11. Economic or Fiscal Impacts: Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: Possible positive financial impacts with increased numbers of Salmon and their commercial harvesting.

12. Forms: If applicable, list any forms to be created, amended or repealed:

Click here to enter text.

SECTION 3: FGC Staff Only

Date received: Click here to enter text. December 16, 2016 3:24pm Via email

FGC staff action:

☐ Accept - complete
☐ Reject - incomplete
☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: January 27, 2015

Meeting date for FGC consideration: April 26-27, 2015

FGC action:

- ☐ Denied by FGC
- ☐ Denied - same as petition _____
  Tracking Number
- ☐ Granted for consideration of regulation change

State of California – Fish and Game Commission
PETITION TO THE CALIFORNIA FISH AND GAME COMMISSION FOR REGULATION CHANGE
FGC 1 (NEW 10/23/14) Page 1 of 5

Tracking Number: 2017-001 (Click here to enter text.)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

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SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
   Name of primary contact person: Sean A. Brady
   Address:
   Telephone number:
   Email address:

2. **Rulemaking Authority (Required) -** Reference to the statutory or constitutional authority of the Commission to take the action requested: The authority cited by the Commission for the regulatory provision sought to be amended includes: Fish & Game Code §§ 200, 202, 203, & 240. However, as explained below, it is unclear whether those cited statutes in fact confer on the Commission authority to adopt the provision in question in the first place, meaning it may be invalid per se.

3. **Overview (Required) -** Summarize the proposed changes to regulations: Subsection (h) of Section 354, of Title 14, Division 1, Subdivision 2, Chapter 3, of the California Code of Regulations ("Section 354(h)") provides that for big game "archers may not possess a firearm while hunting in the field during any archery season, or while hunting during a general season under the provisions of an archery only tag." The only exceptions to this restriction are for: (1) the possession of a crossbow by a person issued a Disabled Archer Permit (Section 354(g),(j)); and (2) current and honorably retired peace officers who are hunting deer during an archery season (California Fish & Game Code section 4370).

   Petitioners seek to have Section 354(h) amended to limit its general restriction on firearm possession to apply only to firearm "use" so that mere possession is not prohibited or, alternatively, to at least add language specifically exempting those with a valid carry concealed weapon license from its restriction, as is already the case for archery hunting for small game (see Section 311(k).)

4. **Rationale (Required) -** Describe the problem and the reason for the proposed change: Section 354(h) should be amended as petitioners request because its current blanket restriction on possessing a firearm while archery hunting for big game is not only bad (and potentially life-threatening) policy, but is also likely illegal.

Improper Regulation

The Administrative Procedures Act ("APA") governs the rule-making processes of the Commission. Under the APA, the validity of a regulation is evaluated by: necessity, authority, clarity, consistency, reference, and non-duplication. (Cal. Gov't. Code § 11349.1). A key purpose of the APA is to limit an agency to adopting only regulations "within the scope of the authority conferred" that are necessary and "consistent and not in conflict with [any] statute . . .." (Cal. Gov't. Code §§ 11342.1–11342.2).

In applying the APA's criteria, Section 354(h) suffers three deficiencies: (1) there is no authority for it; (2) it lacks consistency with general law; and (3) it is not necessary.

Lack of Authority

Under the APA, "authority" is defined as "the provision of law which permits or obligates the agency to adopt, amend, or repeal regulation." Cal. Gov't Code § 11349(b). The only provision cited by the Commission as its basis for authority to adopt Section 354 that is potentially relevant here is subsection (d) of Fish & Game Code § 203, which permits the Commission to prescribe "the manner and the means of taking" animals. "Taking," in this context, is defined as "hunt, pursue, catch, capture or kill game or attempt to hunt, pursue, catch, capture or kill game." Cal. Fish & Game Code § 86.

Section 354(h) categorically prohibits firearm possession while archery hunting—a context unrelated to the "manner" or "means" of "taking" game. The mere presence of a firearm alone has no effect on game. It does not give a hunter any type of unfair advantage per se nor does it cause any harm to game, unless the firearm is improperly ***used***, which conduct the Commission may, and already does, regulate because such qualifies as a "means" of "taking" game. *See*, e.g., Cal. Code Regs. tit. 14, §§ 311(k) (prohibiting use of firearm for hunting small game during archery season); and 507 (prohibiting use of shot size larger than No. BB for taking of migratory game birds).

Thus, Section 354(h) exceeds the scope of the Commission's regulatory authority. But, even if the Commission has the authority to adopt such a regulation, Section 354(h) is nevertheless invalid because it negates provisions of statutes that preempt it and it is unnecessary.

Inconsistency

Under the APA, the term "consistency" is defined as "being in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, or other provisions of law." Cal. Gov't Code § 11349(d). Agency regulations that conflict with statutory law (i.e., lack "consistency") are void. *Assn. For Retarded Citizens v. Dept. of Developmental Services*, 38 Cal. 3d 384, 391 (1985); *accord Credit Ins. Gen. Agents Ass'n v. Payne*, 16 Cal. 3d 651, 656 (1976); *Agric. Labor Rels. Bd. V. Super Ct.*, 16 cal. 3d 392, 419 (1976) (citing *Morris v. Williams*, 67 Cal. 2d 733, 737 (1967)). This doctrine has frequently been invoked to strike down administrative regulations in conflict with the statute creating the agency or a statute the agency is authorized to administer; however "the principle is equally applicable when the regulation contravenes a provision of a different statute." *Agric. Lab Rel. Bd.*, 16 Cal. 3d at 420.

California Penal Code sections 26150 and 26155 exempt the holders of a concealed carry license ("CCW") from California's restrictions on carrying firearms in public. Those sections, along with Penal Code § 26200, confer on Sheriffs and Police Chiefs the exclusive authority to determine who is entitled to a CCW and with what restrictions. By adopting Section 354(h), the Commission has effectively

usurped the statutory authority of those Sheriffs and Police Chiefs by placing restrictions on CCWs that they did not authorize, thereby improperly conflicting with Penal Code sections 26150, 26155, & 26200.

Additionally, Penal Code section 25640 expressly exempts anyone engaged in hunting from section 25400's general prohibition on carrying a concealed firearm in public. Section 354(h) disallows such carrying and thus directly and improperly conflicts with section 25640. *See Fiscal v. City and County of San Francisco* (2008) 158 Cal.App.4th 895, 911 [70 Cal.Rptr.3d 324, 335] (finding an ordinance preempted, in part, because it "would prohibit the possession of handguns by City residents even if those residents are expressly authorized by state law to possess handguns for self-defense or other lawful purposes").

Because Section 354(h) conflicts with general provisions of California law concerning the lawful possession of firearms, it is void and unenforceable and the Commission must amend it. Even if it was not in conflict, Section 354(h) is nevertheless unnecessary.

Lack of Necessity

Under the APA, the term "'Necessity' means the record of the rulemaking proceeding demonstrates by substantial evidence the need for a regulation to effectuate the purpose of the statute, court decision, or other provision of law that the regulation implements, interprets, or makes specific, taking into account the totality of the record. For purposes of this standard, evidence includes, but is not limited to, facts, studies, and expert opinion." Cal. Gov't Code § 11349(a).

The obvious (and understandable) purpose of Section 354(h) is to prevent the illegal and unfair taking of big game with a firearm during archery season. While well-intentioned, however, it is not necessary. Prohibiting the ***use*** of a firearm, while allowing the lawful possession of one, as petitioners request, is sufficient to achieve that goal. There is no "need" to go the next, excessive step of restricting firearm possession by all archers, the vast majority of whom simply want a means to adequately defend themselves, solely based on the hope that doing so will prevent poaching. Nothing in the record of the rulemaking process for Section 354(h) suggests otherwise.

Ironically, a poacher walking around the woods with no license and a firearm (especially a sidearm) during archery season could escape liability under Section 354(h) more easily than a legitimate archery hunter because the poacher would probably not have a license or an archery tag in the first place, making it hard to prove he is pursuing game. Moreover, any warden talented enough to get the job can tell whether an animal has been shot by an arrow or bullet and, if the latter, whether the shot was made in self-defense or offensively.

Unconstitutionality

The Supreme Court has held that the Second Amendment right to keep and bear arms is a fundamental, individual right that includes at its core the right of law-abiding, competent adults to "possess and carry weapons in case of confrontation." *District of Columbia v. Heller*, 554 U.S. 570, 592 (2008). It is improper for the Commission to require archers to forfeit their right to armed self-defense solely as a precaution against the *potential* misuse of the firearm they wish to carry.

Bad Policy

Setting aside legal questions, it is simply dangerous and wrong to have people out hunting, often alone and isolated, without an adequate means to protect themselves from dangerous predators and criminals. This is an issue more so than ever, with the increase of illegal marijuana grows in popular hunting areas that are often patrolled by armed gang members willing to violently defend their crops, as well as the influx of apex predators like bears and mountain lions, and now wolves, due to legal restrictions on hunting them and managing their populations.

Conclusion

For the above stated reasons, NRA and CRPA urge the Commission to accept this Petition and open the rulemaking process for a regulation that amends Section 354(h) to replace the word "possess" therein with the word "use" and add the phrase on the end: ", unless to protect archer from an immediate threat of great bodily harm or death by a person or animal."

Alternatively (or additionally), Petitioners urge that Section 354(h) should be amended to add the following provision:

"Nothing in this section shall prohibit the lawful possession of a concealed firearm by an active peace officer listed in Chapter 4.5 (commencing with Section 830) of Title 3 of Part 2 of the Penal Code or a retired peace officer in lawful possession of an identification certificate issued pursuant to Penal Code Section 25455 authorizing the retired officer to carry a concealed firearm. Nor shall this section prohibit the lawful possession of a concealed firearm pursuant to a concealed carry permit issued pursuant to Penal Code Section 26150 or 26155."

(*See*, e.g., Cal. Code Regs. tit. 14, §§ 311(k) & 550).

The addition of this provision makes clear that peace officers and anyone with a valid CCW are not subject to any restriction on the carrying of firearms in Section 354(h). While there is reason, both legal and practical, to allow all people to carry firearms in the situations Section 354(h) prohibits, this amendment would at least avoid the direct conflict with CCW holders.

SECTION II: Optional Information

5. Date of Petition: February 2, 2017

6. Category of Proposed Change

☐ Sport Fishing
☐ Commercial Fishing
☒ Hunting
☐ Other, please specify: Click here to enter text.

7. **The proposal is to:** (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)
   ☒ Amend Title 14 Section(s): Section 354, subsection (h)
   ☐ Add New Title 14 Section(s): Click here to enter text.
   ☐ Repeal Title 14 Section(s):

8. **If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition** Click here to enter text.
   Or ☒ Not applicable.

9. **Effective date**: If applicable, identify the desired effective date of the regulation.
   If the proposed change requires immediate implementation, explain the nature of the emergency: This is not an emergency. But, the effective date of this regulatory change should be made at the Commission's and Department's earliest convenience to avoid any unnecessary episodes of archers being unable to defend themselves while hunting.

10. **Supporting documentation:** Identify and attach to the petition any information supporting the proposal including data, reports and other documents: Click here to enter text.

11. **Economic or Fiscal Impacts:** Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: None known.

12. **Forms:** If applicable, list any forms to be created, amended or repealed:
    Click here to enter text.

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION
2017 FEB -2 PM 1:17

SECTION 3: FGC Staff Only

Date received: Click here to enter text.

FGC staff action:
- ☐ Accept - complete
- ☐ Reject - incomplete
- ☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: _____

Meeting date for FGC consideration: _____

FGC action:
- ☐ Denied by FGC
- ☐ Denied - same as petition _____
  Tracking Number
- ☐ Granted for consideration of regulation change

California Fish and Game Commission April 12, 2017

Mr. Eric Sklar, President
Mrs. Jacque Hostler-Carmesin, Vice President
Mr. Anthony C. Williams, Member
Mr. Russell Burns, Member
Mr. Peter Silva, Member
1416 Ninth Street, Room 1320
Sacramento, CA 95814

Dear Commissioners,

We write to you as scientists who study the effect of bullfrogs on California's native amphibians. The agenda of your upcoming meeting (April 26-27) includes item 17(A)(I), Petition #2016-030 to add the American bullfrog to the list of restricted species. Our research provides important evidence in support of a decision to approve this petition.

While it has long been known that bullfrogs, as superior competitors and effective predators, can displace native amphibians, only recently have we learned that bullfrogs spread wildlife diseases that harm sensitive species. Please find attached our paper just published in the Ecological Society of America's journal Ecosphere which implicates bullfrogs in an outbreak of the amphibian chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*) that caused a die-off of Foothill Yellow-legged Frogs (*Rana boylii*). The dynamics of wildlife diseases are complex, and bullfrogs, with their pathogens, have long been present in California, so you may ask why is it important for you to take action now.

Our results indicate that against the backdrop of an increasingly variable climate in which extreme droughts will be more frequent and human demands on water resources will amplify, the consequences of unrestricted bullfrog importation will take on new dimensions. Multiple stressors will act in concert in ways previously not imagined. Because bullfrogs are both vectors and reservoir hosts of diseases to which they are resistant, they effectively spread pathogens in natural systems undergoing new environmental stresses. Under the crowded conditions in which live bullfrogs are held in food markets, disease organisms such as *Bd* and Ranavirus can proliferate. When well-meaning people purchase live frogs and make so-called "compassionate releases", new and virulent strains are introduced to ecosystems where the resident fauna have naive immune systems and are susceptible to the diseases.

The listing of *R. boylii* as a threatened species under California's Endangered Species Act is also an agenda item in your upcoming meeting. By approving the petition to restrict bullfrogs, you will also be helping this native frog in great need of protection.

Sincerely,

Sarah Kupferberg

Sarah Kupferberg, Ph.D.
Visiting Scholar, Dept of Int. Biology
UC Berkeley

Andrea Adams, Ph.D.
Dept of Ecology, Evolution, and Marine Biology
UC Santa Barbara

skupferberg

Ph.D., Integrative Biology, University of California, Berkeley 1996

B.S., Botany, Duke University, Durham, NC 1984; magna cum laude, Phi Beta Kappa

Dr. Kupferberg focuses on food web ecology, amphibian population biology, and conservation of aquatic ecosystems in California. She is trained in the design of ecological monitoring programs, experimental design, and data analysis of multi-species assemblages. She studies the effects of flow regulation by dams and diversions on physical and biotic conditions for wildlife. She conducts field research and does experiments in rivers with hydroelectric projects, drinking water reservoirs, and flood control projects. She reviews stream restoration plans and works with engineers to facilitate designs that work from both hydraulic and biologic perspectives. Dr. Kupferberg currently works as an independent consultant and as a part time employee of Questa Engineering. She is currently conducting an investigation of chytrid fungal infections of frogs in the Alameda Creek and participating in a project to re-introduce native ranid frogs to Yosemite Valley.

With regards to husbandry of frogs, Dr. Kupferberg has 20 years experience handling and rearing eggs, embryos, and tadpoles. For her various research projects she has successfully transported eggs and larvae from the field to the laboratory, and from one field location to another. She has reared embryos and tadpoles of *Rana boylii*, *Hyliola regilla*, *Anaxyrus boreas*, and *Lithobates catesbeianus* to metamorphosis; constructed and maintained many types of flow-through stream enclosures, laboratory aquaria, outdoor tanks, and re-circulating troughs. She has conducted experiments manipulating algal food resources, rearing temperature, and current velocity, in which tadpoles were weighed and measured weekly without handling mortality.

Dr. Kupferberg serves as a volunteer technical advisor to Friends of Tesla Park, a community based environmental group aimed at protecting natural resources around the Carnegie State Vehicular Recreation Area in eastern Alameda County. She also serves as an associate editor for the amphibian section of the journal Herpetological Conservation and Biology.

Ecologist with Questa Engineering Corp., Pt Richmond, CA (2001-present)

- Developed study plan and conducted mitigation for removal of Benbow Dam on South Fork Eel River for California State Parks. Organized volunteers to assist in frog egg mass relocation prior to construction spring 2016.
- Designed stream restoration for California Red-legged frog habitat at Lawrence Livermore Lab's Site 300.
- Developed management plans to minimize impact of impoundments on native frogs.
- Conducted site assessments for *Rana draytonii* and *Rana boylii* on several N. California projects.

Ecologist with McBain & Assoc., Arcata, CA (2013-2014)

- For San Francisco Public Utilities Commission assessed amphibian / reptile issues, drafted sections of Habitat Conservation Plan; conducted population monitoring and studies for CEQA Mitigation Monitoring and Reporting Plan; developed ecological models to evaluate in-stream flow proposals for Tuolumne River and Alamada Creek.

Research Assoc., Visiting Scholar, Dept of Integrative Biol., UC Berkeley (2008-11, 2014-17)

- Conducting long term (+20 yr) population monitoring of *R. boylii* and *R. draytonii* (S. Fk. Eel River, Alameda Ck.)
- Completed California Energy Commission sponsored project on the downstream thermal effects of hydroelectric power generation on amphibians and algal food webs.
- Developed population viability analysis methods specific to *R. boylii.*

Consulting Ecologist for US Forest Service re FERC hydropower relicensing (2002-06, 2013)

- Helped design flow studies, developed Federal Power Act section 4e conditions, reviewed draft license applications, and developed monitoring plans for several California rivers including: Pit, N. Fk. Feather, West Branch Feather, Butte Ck., Stanislaus, American, and Tule Rivers
- Drafted the sections of the USFS Conservation Assessment of *Rana boylii*.

Presentations and Teaching

•Chytrid Infection, Drought, and Flow Regulation Create Multiple Stressors on Foothill Yellow-Legged Frog Populations in the Alameda Creek Watershed. California / Nevada Amphibian Populations Task Force Meeting, Pepperdine Univ, Malibu CA. Jan. 2015.

•California Department of Fish and Wildlife, Conservation Lecture Series. Gave presentation on Foothill yellow legged frogs, Dec. 2014.

•Joint Aquatic Sciences Meeting. Special session, The Future of Aquatic Science. "From algal food web ecology to dam management: connecting the dots one tadpole at a time." May 2014

•Friends of the Eel River Science Symposium. Presentation comparing thermal conditions on Eel River below Scott Dam and free-flowing reaches of the South Fork Eel watershed, April 2012

•Jasper Ridge Biological Preserve, Stanford University. Brown-Bag Lecture Series presentation on importance of flow regime and thermal conditions to stream-breeding amphibians, Nov. 2011.

•Geomorphic & Ecological Fundamentals for River Restoration. Taught ecology section of short course organized by Matt Kondolf (UC Berkeley) at Sagehen Creek Field Station, Aug. 2009- 10

•State Water Resources Control Board, Division of Water Rights. Taught section in workshop: Effects of Water Diversion on Ecology and Geomorphology of Small Streams, April 2009

•Upper Tuolumne River Stakeholder Meeting. Presentation reviewing how competing demands for water (e.g. power generation, recreation, irrigation) affect riverine biota. Nov. 2008

•University of California, Berkeley Graduate Student Instructor 1991-1994, Department of Integrative Biology: Intro Biology and Ecology. Department of Geology and Geophysics: The Water Planet (intro to hydrology)

•Yosemite National Institutes, Yosemite National Park and Golden Gate National Recreation Area, California Naturalist / Instructor / Environmental Educator 1988-89.

•Naturalists at Large, Santa Monica, CA; Boojum Wilderness Institutes, San Diego, CA; Venture West School of Outdoor Living, Walnut Creek, CA. Instructor 1986-87

•Sierra Institute, U.C. Santa Cruz Extension, Teaching Assistant Natural History and Ecology of the Sierra Nevada Summers 1986, 1987

Service

- Associate Editor for Herpetological Conservation and Biology
- Volunteer Technical Advisor for Friends of Tesla Park
- Presentations to AP Envtl Studies classes at Skyline High School, Oakland CA
- Peer reviewer for Herpetological Conservation and Biology, Freshwater Biology, Oecologia, Copeia, Ecology, PLoS ONE, Alameda County Resource Conservation District publications

Membership in Professional Societies

- American Society of Ichthyologists and Herpetologists; Ecological Society of America; California Nevada Amphibian Populations Task Force; Society for Freshwater Science

Peer-Reviewed Publications ***indicates *in situ* rearing of embryos and tadpoles in rivers**

Catenazzi A, SJ Kupferberg. 2017. Variation in thermal niche of a declining river-breeding frog: from counter-gradient responses to population distribution patterns. Freshwater Biology *in press*

Kupferberg SJ. 2017. In Search of Lost Frogs—Book Review. Copeia *in press*

Adams AJ, SJ Kupferberg, MQ Wilber, AP Pessier, M Grefsrud, S Bobzien, VT Vredenburg, CJ Briggs. 2017. Extreme drought, host density, sex, and bullfrogs influence fungal pathogen infection in a declining lotic amphibian. Ecosphere *in press*

Power ME, SJ Kupferberg, SD Cooper, ML Deas. 2016. California's River Ecosystems. In: Ecosystems of California, H Mooney, E Zavaleta, eds. University of California Press, Berkeley.

Railsback SF, BC Harvey, SJ Kupferberg, MM Lang, S McBain and HH Welsh Jr. 2016. Modeling potential conflicts between frogs and salmonids. Canadian Journal of Fisheries Science 73:773-784.

Howard JK, KR Klausmeyer , KA Fesenmyer , J Furnish, T Gardali, T Grantham, JVE Katz, S Kupferberg, P McIntyre, PB Moyle, PR Ode, R Peek, RM Quiñones, AC Rehn, N Santos, S Schoenig, L Serpa, JD Shedd, J Slusark, JH Viers, A Wright, and SA Morrison. 2015. Patterns of freshwater species richness, endemism, and vulnerability in California. PLoS ONE DOI: 10.1371/journal.pone.0130710

Carah JK, JK Howard, SE Thompson, AG Short Gianotti, SD Bauer, SM Carlson, DN Dralle, MW Gabriel, LL Hulette, BJ Johnson, CA Knight, SJ Kupferberg, SL Martin, RL Naylor, and ME Power. 2015. High time for conservation: Adding the environment to the debate on marijuana liberalization BioScience 01/2015; 1:1-8. DOI:10.1093/biosci/biv083

Furey PC, SJ Kupferberg, AJ Lind. 2014. The perils of unpalatable periphyton: *Didymosphenia* and other mucilaginous stalked diatoms as food for tadpoles. Diatom Research 29:267–280.

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Kupferberg SJ, WJ Palen, AJ Lind, S Bobzien, A Catenazzi, J Drennan, ME Power. 2012b. Effects of altered flow regimes by dams on survival, population declines, and range-wide losses of California river-breeding frogs. Conservation Biology 26:513-524.

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*Kupferberg SJ. 1997c. Facilitation of primary production by grazing: functionally important differences among species. Freshwater Biology 37:427-439.

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Kupferberg SJ. 1994. Exotic larval bullfrogs (*Rana catesbeiana*) as prey for native garter snakes: functional and conservation implications. Herp Review 25: 95-97.

esa

ECOSPHERE

Extreme drought, host density, sex, and bullfrogs influence fungal pathogen infection in a declining lotic amphibian

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Citation: Adams, A. J., S. J. Kupferberg, M. Q. Wilber, A. P. Pessier, M. Grefsrud, S. Bobzien, V. T. Vredenburg, and C. J. Briggs. 2017. Extreme drought, host density, sex, and bullfrogs influence fungal pathogen infection in a declining lotic amphibian. Ecosphere 8(3):e01740. 10.1002/ecs2.1740

Abstract. Freshwater biodiversity is imperiled across the globe, and multiple stressors such as habitat alteration, non-native species invasion, disease, and climate change can act in concert to threaten vulnerable taxa. The amphibian chytrid fungus *Batrachochytrium dendrobatidis* (Bd), which causes the disease chytridiomycosis, is one of the causative factors of severe amphibian declines. The foothill yellow-legged frog (*Rana boylii*) is a stream-breeding anuran endemic to California and Oregon (USA) that has declined precipitously in recent decades, yet there is little information on its susceptibility to Bd. In the fall of 2013, we observed dead and dying juvenile *R. boylii* in a San Francisco Bay Area watershed where annual amphibian breeding censuses have been conducted since 1997 in a free-flowing reach and since 2003 in an anthropogenically modified stream reach. High pathogen loads on *R. boylii* and histologic lesions observed on a dead *R. boylii* metamorph collected from the site were consistent with lethal chytridiomycosis. The outbreak coincided with extremely low stream flows in autumn that concentrated frogs in drying pools and the absence of high peak flows in winter that allowed non-native American bullfrogs (*Rana catesbeiana*) to expand their spatial distribution in the stream network. Following the outbreak, we surveyed *R. boylii* and sympatric anurans at the site for the next two years to determine Bd trends within the population. Using mixed-effects models, we found that bullfrog presence was a positive predictor of both Bd prevalence and Bd load in *R. boylii*. Prevalence was also influenced by sex and life stage: Adult males were more likely to be infected than either females or juveniles. Moreover, we found that stream flow volume was negatively associated with Bd load. These results indicate that disease, drought, and flow regulation may interact synergistically to impact amphibians in ways not previously recognized, informing stream flow management strategies for native aquatic taxa.

Key words: amphibian declines; *Batrachochytrium dendrobatidis;* chytrid fungus; climate change; dams; disease; drought; multiple stressors; pathogen; *Rana boylii;* rivers; streams.

Received 27 June 2016; revised 29 January 2017; accepted 31 January 2017. Corresponding Editor: Robert R. Parmenter.

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INTRODUCTION

Fungal pathogens causing disease in wildlife are on the rise, with catastrophic consequences for biodiversity (Fisher et al. 2012, Ercan et al. 2015). Anthropogenic disturbances, such as the transport and introduction of non-native species and habitat alteration, can facilitate the dispersal of fungal

pathogens and can cause shifts in their host-specific suitability, making disease outcomes difficult to predict (Fisher et al. 2012, Adlard et al. 2015). Shifts in environmental conditions can also alter host–pathogen relationships, changing disease risk (Dobson and Foufopoulos 2001). In some cases, climate change can increase the incidence and severity of animal pathogens by extending the suitable range of vectors and reservoir hosts, lengthening periods suitable for pathogen transmission, or directly affecting host susceptibility (Harvell et al. 2002, Greer et al. 2008, Eisenlord et al. 2016). In addition, climate change can combine with pre-existing stressors, resulting in cumulative effects to the host (Gallana et al. 2013).

The pathogenic chytrid fungus *Batrachochytrium dendrobatidis* (hereafter Bd) produces the amphibian disease chytridiomycosis in susceptible hosts and has caused declines and extinctions in over 200 species globally (Stuart et al. 2004, Wake and Vredenburg 2008). Bd has altered our understanding of the interaction between diseases and their hosts, in that Bd can cause host extinction, which is unlikely for most pathogens (MacPhee and Greenwood 2013). Bd's ability to infect multiple hosts allows it to maintain itself in less susceptible species while driving more susceptible species to extinction or near extinction (Catenazzi 2015). Therefore, it is crucial to understand the range of host species infected with Bd in ecosystems, and to identify potential reservoir hosts that could increase the threat of chytridiomycosis infection for susceptible species of conservation concern.

Both the biotic and abiotic contexts of Bd outcome must be considered because disease is also strongly shaped by the environment, which can influence the traits of the pathogen and hosts' responses to it (Blaustein et al. 2012). The prevalence and severity of Bd infection can be highly dependent upon local climatic conditions (Kriger and Hero 2007, Savage et al. 2011); however, these effects are not always observed (Knapp et al. 2011). Bd is an aquatic pathogen, requiring a minimum level of moisture to be viable in vitro (Johnson et al. 2003), and is often dependent upon moisture variables in the wild (Kriger 2009). Therefore, it is often suggested that warmer, drier climates may reduce Bd prevalence and loads (Becker and Zamudio 2011, Raffel et al. 2013); however, shifting climates may also increase chytridiomycosis severity as warmer and drier conditions force amphibians to aggregate in reduced areas of moisture, increasing pathogen transmission rates (Burrowes et al. 2004, Lampo et al. 2006, Longo et al. 2010).

Here, we present the results of two years of Bd monitoring in the foothill yellow-legged frog (*Rana boylii*), a stream-dwelling species endemic to California and Oregon (USA) that has declined from over half of its former range (Davidson et al. 2002, Lind 2005). *Rana boylii* is a Species of Special Concern in the State of California (Thomson 2016) and is a candidate for federal Endangered Species Act listing, currently under review (U.S. Fish and Wildlife Service 1994, 2015). A primary driver of *R. boylii* declines is artificial stream flow and temperature regulation by dams (Lind et al. 1996, Kupferberg et al. 2012, Catenazzi and Kupferberg 2013), but the potential role of Bd in the precipitous decline of this species is not yet known. In a location where annual amphibian breeding censuses have been conducted since 2003, a highly anthropogenically modified watershed in California's East San Francisco Bay Area (Fig. 1), we observed dead and dying juvenile *R. boylii* in the fall of 2013. High pathogen loads at the site of dead and dying frogs suggested that the die-off was associated with an outbreak of chytridiomycosis, consistent with high susceptibility in early post-metamorphic individuals observed in other studies (Knapp et al. 2011, Abu Bakar et al. 2016).

The outbreak and two subsequent years of sampling approximately 16 km of stream coincided with the most severe drought event in California in the last 1200 yr (Griffin and Anchukaitis 2014), with 2012–2015 being the driest four consecutive water years since the record began in 1895 (Mann and Gleick 2015, California Department of Water Resources 2016). Extremely low stream flows concentrated frogs in shrinking pools throughout the dry season and the absence of peak flows in the rainy season allowed non-native American bullfrogs (*Rana catesbeiana*) to expand their spatial distribution. Bullfrogs occurred farther away from the lentic environs of a large water impoundment in the surrounding stream network's lotic habitats than had been observed since censuses began. Prior to the recent drought (2012–2015), *R. boylii* were consistently more abundant in the upstream unregulated portions of the study area (Kupferberg et al. 2012), but became relatively more abundant

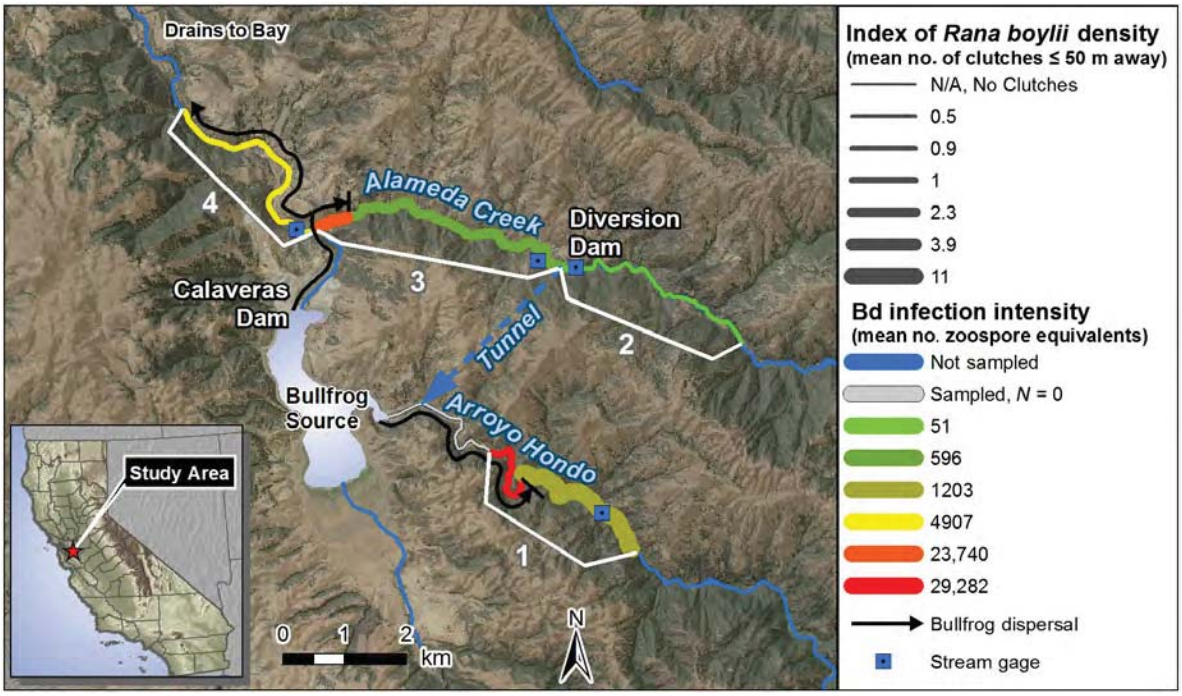

Fig. 1. The location of the study area in Alameda County, California (USA), and the four numbered hydrologically and geomorphologically distinct study reaches: (1) Arroyo Hondo upstream of the reservoir (ochre and red); (2) unregulated Alameda Creek upstream of the diversion dam which delivers water to the reservoir through a tunnel (bright green); (3) downstream of the diversion dam (dark green and orange); and (4) downstream of the confluence of the outflow of Calaveras Dam (bright yellow). Study reach colors correspond to the intensity of Bd infection on foothill yellow-legged frogs (*Rana boylii*) across the reach as well as Bd load of frogs within two infection hot spots (orange segment of Reach 3, and red segment of Reach 4). Line width indicates mean number of *R. boylii* clutches observed within 50 m of capture point of frogs sampled for Bd. Bullfrog (*Rana catesbeiana*) presence/absence status and direction of expansion are indicated by black arrows.

downstream in the regulated reaches (Fig. 2A) which remained wetted throughout the year, while the channels in the upper part of the watershed were completely without surface flow by midsummer (Fig. 2B, C). The 2013 chytridiomycosis outbreak also coincided with this period of shifting frog distribution, prompting us to hypothesize that drought could have played a synergistic role in the Bd outbreak we observed.

The goals of our study were to examine the potential causes of the Bd outbreak and die-off in juvenile *R. boylii,* assess the biotic and abiotic factors that may have influenced Bd prevalence and infection intensity in this population since the outbreak, and suggest which factors may have led to the die-off at this site. In addition, we wanted to better understand the potential for synergistic effects of threats on this declining species and other species affected by Bd.

Materials and Methods

Study site

Located in Alameda County, California, United States, the Alameda Creek watershed (Fig. 1) contains several large water impoundments, including Calaveras Reservoir, which provides a portion of the city of San Francisco's drinking water. Alameda Creek and Arroyo Hondo, the study streams, flow through a series of alluvial valleys and flood plains interspersed with narrow bedrock corridors. Elevations of the study stream reaches range from approximately 130 to 360 m above sea level. The Alameda Creek

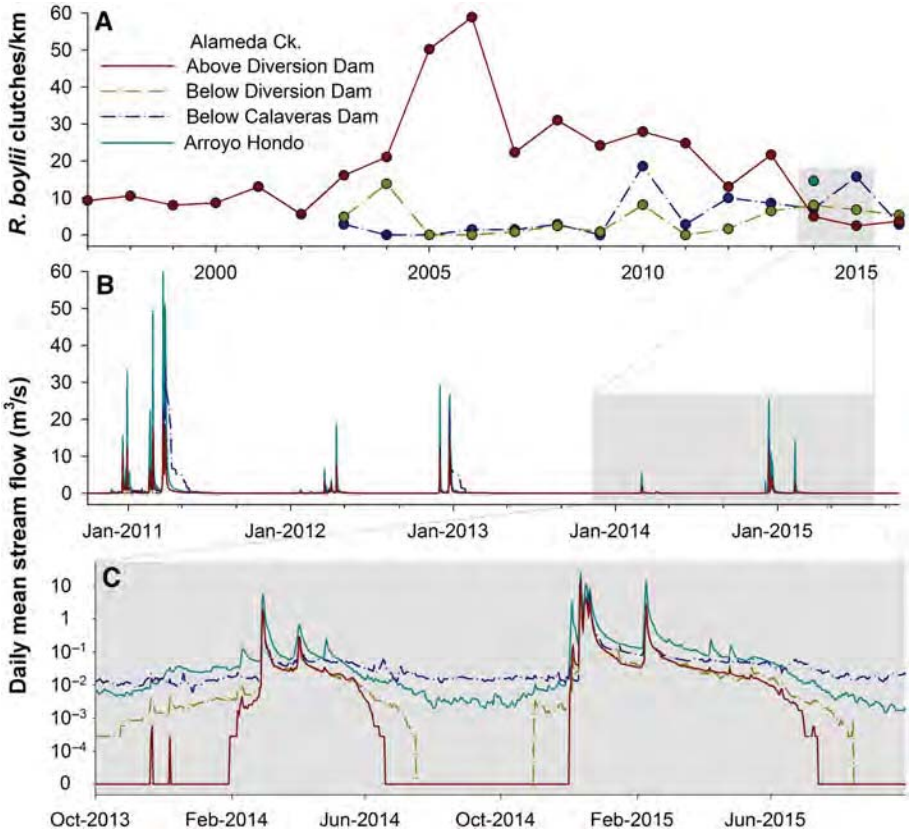

Fig. 2. (A) Breeding population size of *Rana boylii*; (B) daily mean stream flows in the study reaches of Arroyo Hondo and Alameda Creek prior to (i.e., 2011) and during a prolonged drought (2012–2015), showing reduced magnitude of winter flooding for all stream reaches in dry years and in regulated reaches in a normal rainfall year; and (C) differences in flow regime among reaches when sampling of amphibians for Bd occurred. Free-flowing reaches are indicated by solid lines, and regulated reaches by broken lines. A water year spans from 1 October to 30 September.

sampling area consists of three hydrologically distinct reaches: unregulated (i.e., no upstream dams or water diversions); below the Alameda Creek Diversion Dam (which delivers water to Calaveras Reservoir through a tunnel); and below the confluence with Calaveras Creek, which conveys releases from Calaveras Dam to Alameda Creek. The second stream sampled, Arroyo Hondo, is unregulated, but flows into the reservoir (Fig. 1). The four study reaches are also distinct from each other with respect to faunal composition of fish communities, land use (e.g., cattle grazing, recreation), and are different with respect to factors affecting water temperature such as composition of streamside vegetation (shrubs vs. trees), extent of shading by riparian canopy, and height of canyon walls. *Rana boylii* can move upstream and downstream within both creeks, but migration distances in this system are unknown. A genetic analysis of frogs sampled in the various reaches indicates that *R. boylii* do not move around the reservoir and that it represents a barrier to gene flow (Peek 2012). The *R. boylii* population in the Alameda Creek watershed is one of the last populations of the species in the county, where it was formerly widespread.

Sampling methods

For two years following the fall 2013 Bd outbreak in which we observed dead and dying juveniles and recorded Bd loads that are lethally high in other ranid species (mean $\log_{10}$ Bd load $\pm$ standard error: 3.45 $\pm$ 0.36; Briggs et al.

2010, Vredenburg et al. 2010, Kinney et al. 2011), we sampled *R. boylii* for Bd and sampled other frog species encountered during the course of our surveys. We also collected a dead *R. boylii* metamorph from the die-off on 7 November 2013 for histologic analysis, which we conducted following Reeder et al. (2012). From November 2013 to September 2015, we surveyed 16 km of stream habitat (Fig. 1) during the day, when *R. boylii* are most active. The cryptic nature of *R. boylii* and its low densities in this system make capturing a large number of individuals a challenge (Appendix S1: Fig. S1). Effort was made to equalize sample size among seasons—we made several more visits during cold weather in the winter when frogs are extremely difficult to locate in order to not disproportionately weight the number of summer samples. There were a total of 30 field days dedicated specifically to Bd sampling (Appendix S1: Table S1). We walked along the banks, waded in the channel, and captured amphibians with gloved hands. We recorded water temperature with a quick-read thermometer and recorded latitude and longitude of capture locations with a hand-held GPS device (Garmin GPSmap 60Csx, Olathe, Kansas, USA). Locations of all encountered bullfrogs and signal crayfish (*Pacifastacus leniusculus*), even if not captured, were also noted. Upon capture, we recorded sex, length (snout-urostyle length for post-metamorphic individuals; body length for tadpoles, using dial calipers), and swabbed for Bd using sterile, rayon-tipped swabs (Medical Wire and Equipment, Corsham, Wiltshire, England) following a standardized protocol (Hyatt et al. 2007). Post-metamorphic individuals were swabbed five times each on the bottoms of the feet, on the ventral thighs, and both sides of the drink patch. Tadpoles were sampled by swabbing across the beak and tooth rows 30 times. A fresh pair of gloves was used to handle each animal to prevent cross-contamination. Swabs were individually placed in sterile screw-cap vials and then frozen upon return from the field (within 6–8 h).

Batrachochytrium dendrobatidis dynamics in a population are often characterized by a positive relationship between Bd prevalence (the proportion of infected individuals) and Bd load (a measure of infection intensity) during an epidemic (Briggs et al. 2010). To test for the quantity of Bd in each sample (Bd load), we used a real-time PCR assay (qPCR). Using qPCR analysis, infection intensity is determined in terms of zoospore equivalents (ZE), the number of zoospores on the swab sample as compared to a standard curve of serial dilutions of standard Bd DNA. After extracting DNA from swabs using 40 μL of PrepMan Ultra (Applied Biosystems, Foster City, California, USA), qPCR analysis followed a standardized protocol (Boyle et al. 2004), and samples were run on a StepOnePlus real-time PCR system (Applied Biosystems). Positive controls in quantities of 0.1, 1, 10, and 100 ZE were run in addition to negative controls (PCR water only). Negative controls indicated that there was no false-positive amplification on any of the qPCR plates.

We assessed the local density of *R. boylii* by conducting a breeding census of the full study reach (16 km) in the spring of 2014 following the same protocol (Kupferberg et al. 2012) used for long-term monitoring of sub-sections of Alameda Creek ($km_{unregulated\ 1997–2016} = 1.64$; $km_{below\ diversion\ dam\ 2003–2016} = 0.7$; $km_{below\ Calaveras\ Dam\ 2003–2013} = 1.23$; $km_{below\ Calaveras\ Dam\ 2015–2016} = 3.69$). For ranid frogs that oviposit a discrete mass of eggs (clutch) per year, clutch counts are a commonly used index (Petranka et al. 2007). *Rana boylii* clutches are readily visible on the rocks where they are attached, and are much more conspicuous than the frogs themselves (Appendix S1: Fig. S1) which spend more than half their time below water and under substrates (Gonsolin 2010). Clutch counts closely correspond to the number of adult females (Van Wagner 1996). Spatial clustering in 2015 mirrored that of 2014, so the 2014 density estimates were applied to both study years. This mirroring is consistent with the pattern that *R. boylii* congregate and breed at the same lek sites from year to year (Kupferberg 1996, Wheeler and Welsh 2008). Males begin arriving at the breeding sites in early March and remain in the vicinity of the leks for several weeks after the last female oviposits, and tadpoles and juveniles generally remain within the natal riffle–pool sequence until fall rains trigger dispersal. Every 10–14 d we searched for clutches and marked them by placing a bamboo skewer with flagging in the stream bed. We repeated surveys until no new clutches were found and noted any previously overlooked clutches. For each swab or egg mass location, we took a GPS reading and converted that latitude and longitude to a stream station. Stream stations

are given in river kilometers, defined as a measure of distance tracing the line of steepest ascent in the river channel from its outlet. San Francisco Bay is designated as zero, and distances increase as one moves upstream (U.S. Geological Survey 2015). We calculated stream distances as the difference between the stream station values for each swab location using ArcGIS 10.1 (ESRI, Redlands, California, USA). We calculated two variables from stream station: (1) "Bullfrog Distance," which is the distance from point of capture to the nearest bullfrog observation, and (2) "*R. boylii* clutches," which is the number of *R. boylii* egg clutches observed 25 m upstream and 25 m downstream of point of capture (50 m total distance; Table 1).

Analyses and hypothesis evaluation

We used generalized linear mixed-effects models (GLMMs) and an information-theoretic approach to test various hypotheses for which factors best predict Bd prevalence and load in *R. boylii* and in bullfrogs (four models in total). Using mixed-effects models enabled us to account for non-independence of samples that were collected at the same locality on the same day, as well as to evaluate predictors at the individual or site-specific level. To accomplish this, in every model we included "survey event," a variable created to group frogs sampled on the same date and within the same one of the four study reaches, as a random effect; there were 24 levels of this random effect. To ensure that our results were not driven by this choice of random effect, we also explored a number of alternative random effects in the model, including a continuous random effect accounting for spatial autocorrelation between samples (Appendix S2). These more complex random effects (i.e., error structures) did not affect our inference, and thus, we present the simpler "survey event" random effect in this paper.

Based on the literature, we expected Bd prevalence and load to vary according to different biotic and abiotic factors (Table 1). We hypothesized that drought conditions would positively affect Bd prevalence and load if amphibians become highly concentrated in some reaches as the stream flow becomes intermittent—we expected Bd transmission rates and Bd susceptibility (due to stress) to increase as a function of host density (Rachowicz and Briggs 2007, Peterson and McKenzie 2014, Brannelly et al. 2015). We therefore included as predictor variables in the model several metrics of hydrologic conditions derived from stream gauge data (collected by the U.S. Geological Survey) that could be indicative of the current drought (including water temperature) and the number of *R. boylii* egg clutches within 50 m of each frog location/Bd sampling locality (Table 1). This 50-m distance scales with the morphology of the channel and the boundaries of a given riffle–pool habitat unit. The typical wetted width of our sampling sites was 8–9 m, and the wavelength of the riffle–pool cycle is five to seven times the channel width (Langbein and Leopold 1964).

In addition to the temperature-dependent rate of both Bd growth (Piotrowski et al. 2004) and responses of amphibians to chytridiomycosis (Raffel et al. 2010, Becker et al. 2012), seasonal changes in climate can affect Bd outcome through host factors such as behavior, transmission opportunities, and immune function (Kriger and Hero 2007, Rowley and Alford 2007, Ribas et al. 2009, Kinney et al. 2011). Therefore, we hypothesized that there could be variation in seasonal effects on Bd. We used a water year variable to determine whether there was an effect of time as the multi-year drought continued. Water year 2014 is 1 October 2013 through 30 September 2014, and water year 2015 is 1 October 2014 through 30 September 2015.

Additional biotic variables of interest in this system include the presence of non-native species, bullfrogs, and crayfish. Bullfrogs are capable of becoming infected with Bd, but do not appear to succumb to chytridiomycosis when infected with most strains, making them a potential disease vector and reservoir, both in the live amphibian trade and in the wild (Daszak et al. 2004, Garner et al. 2006, Schloegel et al. 2012, Gervasi et al. 2013). Since both bullfrogs and crayfish can harbor Bd and are capable of transferring infection to amphibian hosts (Greenspan et al. 2012, McMahon et al. 2013, but see Betancourt-Roman et al. 2016), we expected the presence of these invasive species to positively influence Bd in the system. We also tested for effects of different biometric variables (i.e., length, stage, and sex; Table 1) as these have been associated with Bd prevalence and load in amphibian populations (Kriger et al. 2007, Garner et al. 2009, Imasuen et al. 2011).

Driven by the aforementioned hypotheses, we used a forward selection procedure with the GLMMs to determine the predictor variables that

Table 1. Variables used in mixed-effects models to predict Bd load and probability of Bd infection.

Covariate	Type	Range or levels	Description
Season 3	Environmental/ Temporal	Winter/Spring; summer; fall	Winter/Spring: 1 December to 31 May; Summer: 1 June to 31 August; Fall: 1 September to 30 November
Season 2	Environmental/ Temporal	Wet, dry	Wet season: 1 December to 31 May; Dry season: 31 June–30 November
Hydrologic unit/ Flow regime	Environmental/ Geographic (anthropogenic)	Alameda Creek: unregulated; diversion; dam release and diversion Arroyo Hondo: unregulated	Stream and flow regime where sampling occurred
Water year	Environmental (drought)	2014, 2015	1 October–30 September
Water temperature	Environmental/ Temporal (drought)	9.9–23.0°C	Temperature of stream†
Days since peak stream flow	Environmental (drought)	6–429 d	Number of days since peak stream flow for the respective water year
Preceding peak stream flow	Environmental (drought)	4.9–121.8 m^3/s	Peak flow of respective water year that preceded survey date‡
Mean daily stream flow	Environmental (drought)	0–0.12 m^3/s	Mean daily flow on the survey date‡
Drought index	Environmental (drought)	1.0–54.4 d/m^3s^{-1}	Days since the peak flow of the respective water year divided by the magnitude of that peak flow
Sex-stage§	Biological	Tadpole, juvenile, female, male	Combination of sex (if stage is adult) and stage (larval or juvenile) if not adult
Stage¶	Biological	Tadpole, post-metamorphic	Indicates whether pre- (i.e., tadpoles) or post-metamorphic (juveniles and adults)
Length	Biological	21.2–67 mm	Snout-vent length (for adults); body length (for tadpoles and juveniles); measured with dial calipers
Crayfish§	Biological (invasive species)	Present, absent	Binary indication of whether crayfish are present at the site
Bullfrogs§	Biological (invasive species)	Present, absent	Binary indication of whether bullfrogs observed at the site
Bullfrog time§	Biological (invasive species)	Absent, recent, established	History of bullfrog observations at site (absent = no observations 1997–2015; recent = observed during drought 2012–2015; established = observed pre-drought)
Bullfrog distance§	Biological (invasive species)	0.0–8027.8 m	Distance to the nearest bullfrog along the stream
Rana boylii clutches	Biological	0–19	Number of *R. boylii* egg clutches within 50 m (25 m upstream and 25 m downstream) of sample collection site

Note: Bd, *Batrachochytrium dendrobatidis*.

† Water temperature was measured with a thermometer at the site of capture. If thermometer temperature was not available, then median daily temperature from the nearest USGS gage station was used, via National Water Information System: Web Interface (https://waterdata.usgs.gov/nwis).

‡ Measured at USGS stream gage for respective reach, accessed using National Water Information System: Web Interface. Gages used: 11173200—Arroyo Hondo near San Jose, California; 11172945—Alameda Creek above diversion dam, near Sunol, California; 11172955—Alameda Creek below diversion dam, near Sunol, California; 11173510—Alameda Creek below Calaveras Creek, near Sunol, California.

§ Variables used in *R. boylii* models only.

¶ Variables used in bullfrog models only.

were the best fit to the data. Predictor variables were sequentially tested for all four models in the order as presented in Table 1. We log-transformed the ZE values for the model with *R. boylii* Bd load as a response variable. We *z*-transformed all continuous predictor variables so that effect sizes of different predictors were comparable. Only post-metamorphic *R. boylii* were used in both *R. boylii* Bd prevalence and load models since all *R. boylii* tadpoles were Bd negative. Interactions

were included in the models whenever biologically appropriate. We ranked candidate models according to Akaike's information criterion (AIC) to determine the relative importance of predictor variables within each model set. The models with the lowest AIC were considered the best-supported models by the data, and models with a $\Delta AIC > 2$ as compared to the model with the lowest AIC were considered not as well supported by the data (Burnham and Anderson 2004). We complemented this information-theoretic approach by computing likelihood ratio tests for nested models. Variance inflation factors (VIFs) were used to determine that none of the fixed effects in the best-fit models were collinear, as indicated by VIF values <3 (Zuur et al. 2010). We conducted all analyses in the R computing environment (R Development Core Team 2012). Generalized linear mixed-effects models were fit using the "glmer" (for Bd presence/absence models) and "lmer" (for the Bd load models) functions in the "lme4" package (Bates 2010). If a model failed to converge using these functions, we refit the identical model using a Bayesian approach with slightly regularizing prior distributions on the model coefficients. This allowed for convergence of the model while guarding against overfitting (McElreath 2016).

Results

Histologic examination of serial transverse sections of a dead *Rana boylii* metamorph collected from the 2013 die-off revealed lesions of moderate to severe epidermal hyperplasia and hyperkeratosis and myriad intralesional chytrid-type fungal organisms consistent with lethal chytridiomycosis (Appendix S1: Fig. S2). No visceral lesions of other infectious diseases known to cause mortality events of metamorphs (e.g., Ranavirus) were observed. Between 7 November 2013 and 11 September 2015, *R. boylii* were the most frequently encountered species throughout the study reaches (Fig. 3A). We captured and sampled 142 *R. boylii* individuals (127 post-metamorphic), along with four *Anaxyrus boreas halophilus* (California toad), 26 *Hyliola regilla* (Pacific treefrog), 10 *Rana draytonii* (California red-legged frog), and 33 *Rana catesbeiana* (American bullfrog). Bullfrog observations were restricted to sites downstream of 170 m elevation in Alameda Creek and downstream of 228 m elevation in Arroyo Hondo (Figs. 1, 3A). All species tested positive for Bd, and infection prevalence (Fig. 4A) for all species combined was 40% (87 of 216 samples). Bd-positive individuals were found across all reaches, from the most downstream to the most upstream extent of the surveys. Among species, Bd loads were highest in *R. boylii* and bullfrogs (Fig. 4B). Within *R. boylii*, males were more likely to be infected than either females or juveniles (Fig. 5D).

The model analyses of post-metamorphic *R. boylii*, for both Bd presence/absence and Bd load, indicated that spatial and temporal environmental factors were important. The presence of bullfrogs had a positive influence on Bd infection (Appendix S1: Tables S2, S3; Figs. 5, 6). While Bd prevalence was higher in water year 2015 than in 2014 (Fig. 5), none of the stream flow metrics included were important predictor variables based on the best-fit models for Bd presence/absence in *R. boylii* (Appendix S1: Table S2). For Bd load however, a marginally significant negative association of mean daily stream flow was included among the best-fit models (i.e., significant at $\alpha = 0.1$, but not at $\alpha = 0.05$; Table 2, Appendix S1: Tables S2, S3; Fig. 6). Two of the best-fit models for Bd load in *R. boylii* included an interaction between season and mean daily stream flow (Appendix S1: Table S3). Bd loads in *R. boylii* were generally lower in summer than in fall (Fig. 6C), and stream flows were lowest in fall (Fig. 2). The local density of conspecifics, as indicated by the number of *R. boylii* egg clutches within 50 m of each capture location, was also a significant positive predictor of Bd load in *R. boylii* (Table 2 and Appendix S1: Table S3; Fig. 6E).

Because bullfrogs were among the most important predictors of Bd in both the *R. boylii* load and prevalence models, and bullfrogs are potentially a Bd reservoir in the systems they inhabit, we also included models of Bd in bullfrogs to see which factors best predict Bd infection in that species. The best predictors of Bd presence/absence in bullfrogs included a positive effect of water temperature and an effect of life stage, in which post-metamorphic individuals were more likely to be Bd positive than tadpoles (Table 2; Appendix S1: Table S4; Fig. 7). In the bullfrog Bd load model, none of the predictors improved the model beyond the intercept-only model (Appendix S1: Table S5).

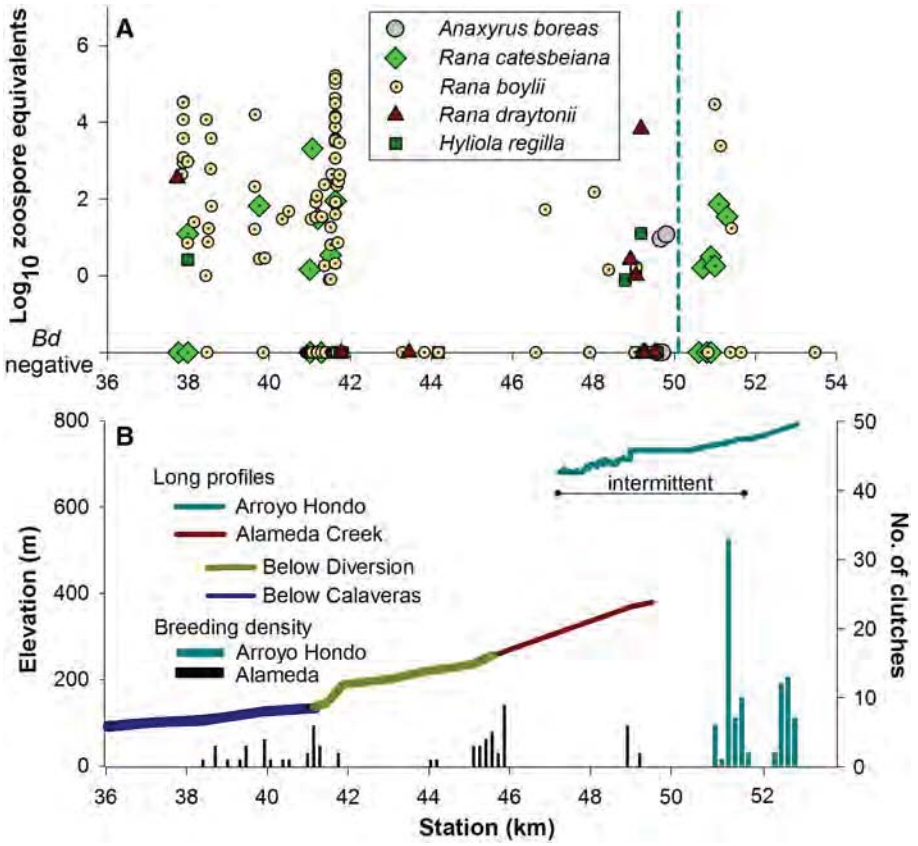

Fig. 3. (A) Pathogen load by species at stream station locations. Left of the vertical dashed line is Alameda Creek; right of the dashed line is Arroyo Hondo. (B) Stream profiles (lines) and number of *Rana boylii* clutches (bars) observed at stream station locations along Alameda Creek and Arroyo Hondo in 2014. Breeding sites were visited an average of four times between 13 March and 14 May (during the oviposition season). In Alameda Creek, only the reach depicted in dark blue remained continuously wetted throughout the drought.

Discussion

Bd susceptibility in Rana boylii

Our observations of relatively high Bd loads and lesions consistent with severe chytridiomycosis coinciding with a mass mortality event make this the first published report of lethal chytridiomycosis in *R. boylii* in the field. Although Bd has been detected many miles upstream of the current study site in a tributary of Arroyo Hondo over the last decade (Padgett-Flohr and Hopkins 2010), these were the first indications of negative effects of Bd infection among lotic-breeding frogs in the watershed. Bd has been documented in the watershed from museum specimens collected in 1966, and in live animals as recently as 2007 (Padgett-Flohr and Hopkins 2009, 2010), approximately 5 miles upstream of the closest sampling location used in this study, but it is possible that the 2013 outbreak may have been the result of an introduction of a novel genotype of Bd to the watershed. Even when genotypes are the same (e.g., belonging to the widespread, deleterious Global Panzootic Lineage of Bd), local variation in phenotype can lead to differential Bd outcome in the host (Lambertini et al. 2016), so a novel variation in genotype is not essential for a shift from enzootic to epizootic conditions.

Our observations that *R. boylii* can be susceptible to the lethal consequences of chytridiomycosis in the field are in contrast to laboratory experiments (Davidson et al. 2003, 2007) and a field study (Lowe 2009) that found reduced growth or body condition in Bd-positive juveniles, but which

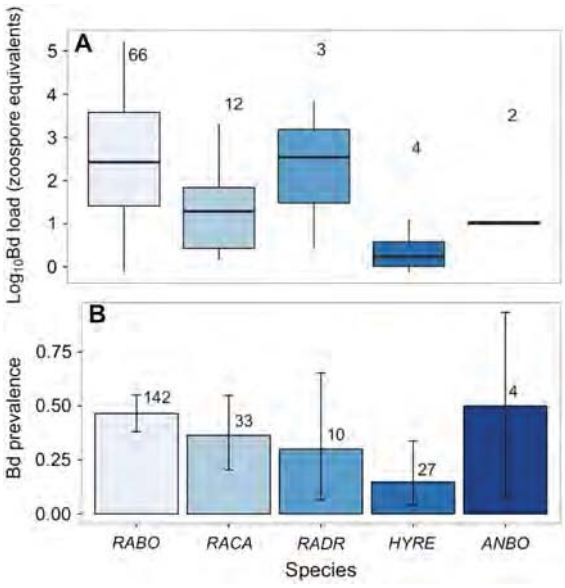

Fig. 4. (A) Bd load and (B) Bd prevalence for all anuran species sampled at the study site. Bold horizontal lines within each boxplot in (A) indicate the median, boxes show the interquartile (IQ) range, and whiskers show the range within 1.5 times the IQ range. Error bars in (B) represent the 95% Clopper–Pearson binomial confidence intervals. Numbers above the bars indicate (A) the number of Bd-positive individuals or (B) total sample size for each species. Species codes: *RABO, Rana boylii* (foothill yellow-legged frog); *RACA, Rana catesbeiana* (American bullfrog); *RADR, Rana draytonii* (California red-legged frog); *HYRE, Hyliola regilla* (Pacific treefrog); *ANBO, Anaxyrus boreas halophilus* (California toad).

were inconclusive with respect to chytridiomycosis-induced mortality. Significant within-species variation in Bd outcome is not uncommon (Briggs et al. 2010, Bradley et al. 2015). Indeed, when the experiment of Davidson et al. (2007) was repeated, and *R. boylii* from the same location were exposed to the same Bd strain, the result was 100% mortality (C. Davidson, *unpublished data*). Different disease outcomes could result from variation in a variety of biotic or abiotic factors, including immunity-related factors, such as composition of the skin microbiome (Krynak et al. 2016), differences in antimicrobial peptides (AMPs), behavior, or major histocompatibility complex genotype (Rollins-Smith and Conlon 2005, Savage and Zamudio 2011). The AMPs in *R. boylii* skin have been found to be highly active against Bd in culture (Davidson et al. 2007); however, species with peptides active in vitro such as the mountain yellow-legged frog (*Rana muscosa*) can still be highly susceptible to Bd infection in nature (Rachowicz et al. 2006, Rollins-Smith et al. 2006).

Climate

Increasing volatility and variability in predicted precipitation is expected to have considerable conservation consequences for amphibians, which can have highly specific flow and moisture requirements (Walls et al. 2013). A spatial analysis of *R. boylii* decline suggested that climate change may be influencing the species' northward range

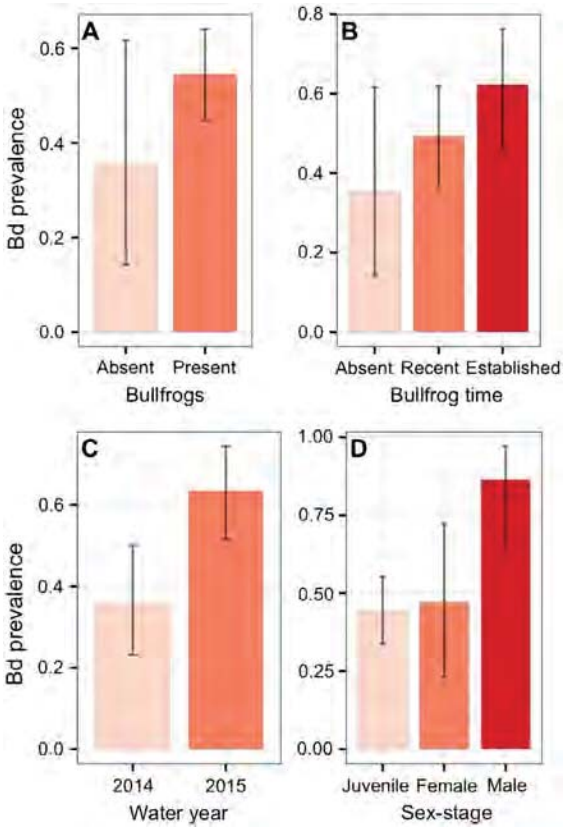

Fig. 5. Relationship between Bd prevalence in *Rana boylii* and the most important explanatory variables as determined by the best-fit mixed-effects models (Table 2 and Appendix S1: Table S2), including (A) Bullfrog presence/absence; (B) length of time of bullfrog presence; (C) water year; (D) sex/life stage. Error bars indicate 95% Clopper–Pearson binomial confidence intervals. Descriptions of explanatory variables are in Table 1.

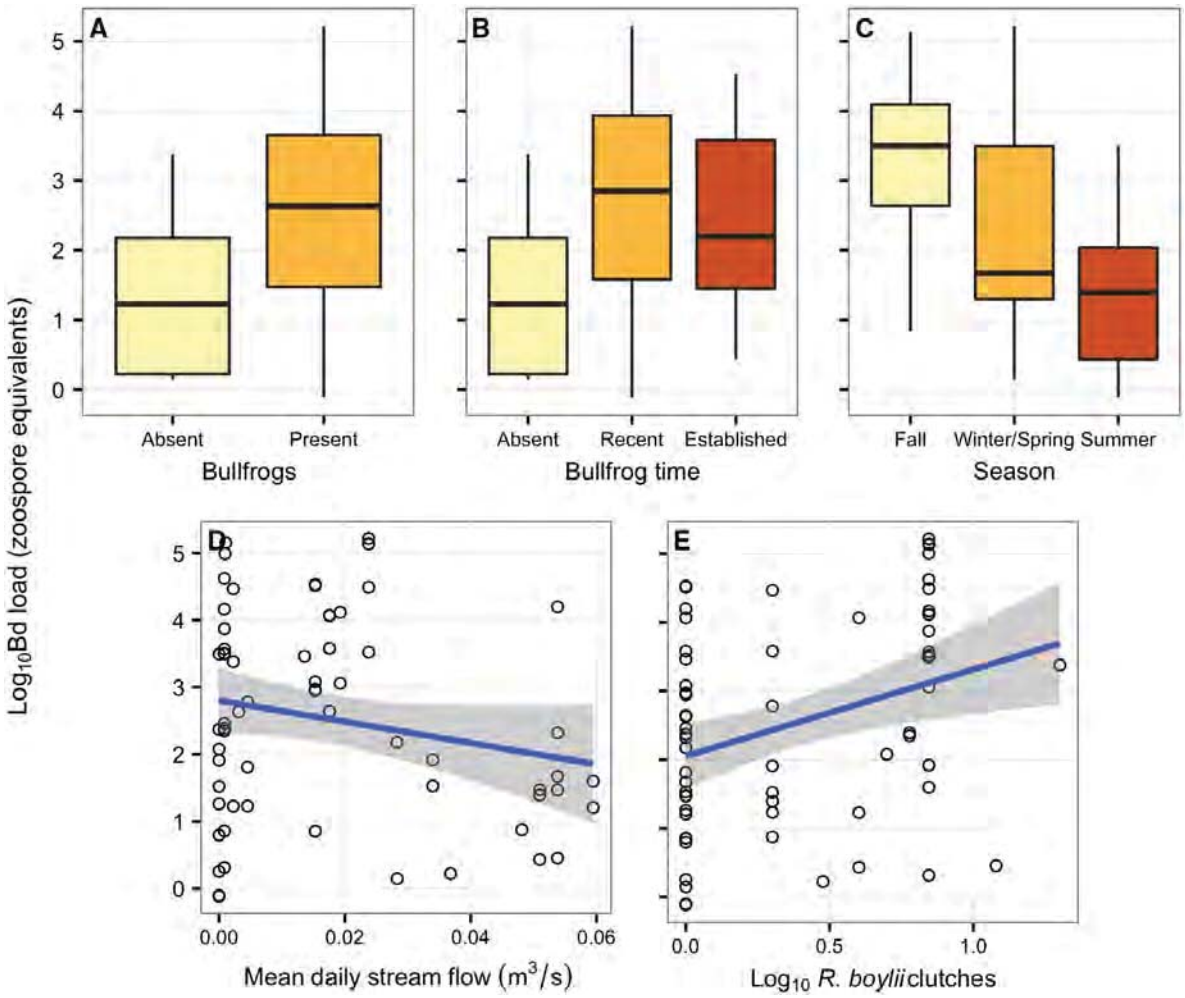

Fig. 6. Relationship between Bd loads of infected *Rana boylii* and the most important explanatory variables as determined by the best-fit mixed-effects models (Table 2 and Appendix S1: Table S3), including (A) bullfrog presence/absence; (B) length of time of bullfrog presence; (C) season; (D) mean daily stream flow; and (E) number of *R. boylii* clutches within 50 m of each Bd sampling point. Both (D) and (E) depict the best-fit line for a regression of the two continuous variables against $\log_{10}$ Bd load. Descriptions of explanatory variables are in Table 1.

contraction (Davidson et al. 2002). In addition, during the drought, the previously robust population in the upstream unregulated reach of Alameda Creek declined steadily to the lowest number observed during 20 yr of annual monitoring (Kupferberg et al. 2012, Fig. 2A). This, coupled with our observation that Bd loads in *R. boylii* increase at lower stream flows, indicates that climate change, water extraction for human use, and disease may be acting synergistically to threaten *R. boylii* populations in central California and amphibians globally. Bd zoospores, the infective stage of the pathogen, are flagellated and actively swim in the water column (Piotrowski et al. 2004), so could be concentrated at lower flows. This has been observed in laboratory experiments, in which Bd naïve frogs had significantly decreased time to mortality and Bd growth rate at higher flow rates, presumably because of the increased availability of zoospores at lower current velocities (Tunstall 2012).

Our observation that water temperature has a positive relationship with Bd infection in bullfrogs is consistent with the optimum range of temperatures for Bd growth in amphibian species of temperate regions (Raffel et al. 2010, Becker

Table 2. Parameter estimates for best-fit models (see Appendix S1: Tables S2–S4) used to determine the best predictors of (A) Bd presence/absence in *Rana boylii*; (B) Bd presence/absence in bullfrogs; and (C) Bd load in *R. boylii*.

Model	Parameter	Estimate	SE	*z*	*P*
(A) Bd presence/absence (*R. boylii*; $R^2 = 0.35$)	(Intercept)	−5.32	2.99	−1.78	0.08
	Water year 2015	4.29	2.73	1.57	0.12
	Sex-stage (Juveniles)	−0.47	1.49	−0.32	0.75
	Sex-stage (Males)	4.90	2.56	1.92	0.06
	Bullfrog time (Established)	3.25	2.48	1.31	0.19
	Bullfrog time (Recent)	5.10	2.62	1.94	0.05
(B) Bd presence/absence (bullfrogs; $R^2 = 0.95$)	(Intercept)	−4.54	1.84	−2.47	0.01*
	Water temperature	5.88	2.49	2.36	0.02*
	Stage (Post-metamorphic)	9.78	4.53	2.16	0.03*
		Estimate		**95% CI (lower, upper)**	
(C) Bd load (*R. boylii*; $R^2 = 0.53$)	(Intercept)†	4.42		2.09, 6.76	
	Season 3 (Summer)†	−4.60		−6.24, −2.95	
	Season 3 (Winter/Spring)	−0.43		−2.97, 1.89	
	Mean daily stream flow	−1.13		−2.40, 0.22	
	Bullfrog time (Established)†	3.06		0.80, 5.47	
	Bullfrog time (Recent)†	2.48		0.18, 4.84	
	R. boylii clutches†	0.82		0.14, 1.53	

Notes: SE, standard error. Confidence intervals (CI) were calculated using a parametric bootstrap. R^2 values presented for each model were calculated for the fixed effects.

* $P < 0.05$.

† Parameter estimates with 95% CI that do not overlap zero.

et al. 2012), although temperature variability and not just absolute temperature can also affect host responses to Bd (Raffel et al. 2013). The majority of Bd positives in bullfrogs in this study occurred when water was warmer than 17°C (Fig. 7B), which is the lower end of the thermal optimum growth range of Bd (Piotrowski et al. 2004, Woodhams et al. 2008). California climate change projections under a range of emissions scenarios predict a 1.5–4.5°C increase in air temperatures within the next century (Cayan et al. 2008), consistent with historical observations and projections of future river temperatures in the United States (Kaushal et al. 2010, van Vliet et al. 2013). Therefore, temperatures could rise into Bd's thermal optimum growth range in portions of the Alameda Creek watershed, potentially increasing the prevalence of Bd in bullfrogs in this system. Although stream temperatures largely follow air temperatures, they are spatially heterogeneous as a result of microgeographic factors such as tributary plumes, influx of groundwater, and canopy shading, creating locally cooler conditions (Webb et al. 2008, Fullerton et al. 2015, Wawrzyniak et al. 2016). For example, planned hypolimnetic releases from Calaveras Reservoir after the completion of the Calaveras Dam Replacement Project (now under construction) will cool Alameda Creek downstream of the confluence with Calaveras Creek (Study Reach 4, Fig. 1) by as much as 5°C (McBain Associates 2014). This is below the realized thermal niche for *R. boylii* tadpoles (Catenazzi and Kupferberg 2013, Wheeler et al. 2015), but may limit Bd in bullfrogs.

In vitro, Bd has the ability to rapidly adapt to a broad spectrum of thermal conditions by optimizing its growth rate, which may affect the severity of chytridiomycosis in the host (Voyles et al. 2012). Therefore, while present temperatures may be in the optimum range for growth in the bullfrog reservoir host, Bd may be able to adapt to local temperature shifts. Our observation that Bd prevalence is higher in bullfrogs at temperatures that are optimum for the fungus in vitro is supported by the thermal optimum hypothesis, but is speculative given that Bd's response to temperature in the host is complex (Fisher et al. 2009, Raffel et al. 2013). In laboratory experiments, hosts infected with Bd have shown different responses to increased temperatures, ranging from no response to increased survival (Berger et al. 2004, Carey et al. 2006, Andre et al. 2008). In contrast to our observations that warmer temperatures appear to positively

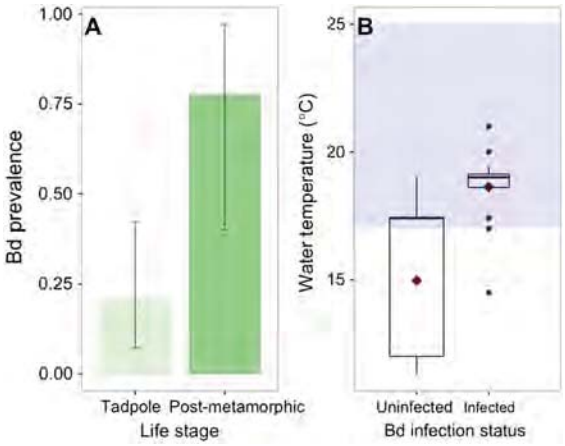

Fig. 7. Bd infection in non-native American bullfrogs (*Rana catesbeiana*), with (A) Bd prevalence by life stage and (B) Bd infection status at the range of water temperatures observed. Error bars in (A) indicate 95% Clopper–Pearson binomial confidence intervals. Bold bars in (B) indicate the median; lower and upper hinges indicate the 25% and 75% quantiles, respectively; and lower and upper whiskers indicate the smallest and largest observations greater than or equal to the upper and lower hinges—1.5 times the interquartile range, respectively. Red diamonds represent the means and the blue shaded area represents the Bd thermal optimum growth range from Piotrowski et al. (2004).

influence Bd infection in bullfrogs in this system, we observed lower Bd loads in *R. boylii* in summer (Fig. 6C). However, temperature was not an important predictor of either Bd load or prevalence in the *R. boylii* models.

Bullfrogs

Our findings that both the probability of Bd infection and the probability of Bd load are higher in *R. boylii* when bullfrogs are present are supported by a prior field study that showed a positive relationship between Bd prevalence and load and bullfrog density in native amphibian populations sympatric with non-native bullfrogs (Peterson and McKenzie 2014). Because they prefer pools with little or no flow, bullfrog densities in rivers can increase during drought years in California's Mediterranean climate (i.e., cool, wet winters and warm, dry summers), particularly after years with low winter peak discharges (Kupferberg 1997, Doubledee et al. 2003). We attribute the influence of water year on Bd prevalence in *R. boylii* to the continued expansion of bullfrogs into the study area through water year 2015. In addition, the site of the 2013 die-off is the zone of most recent contact with bullfrogs in the stream, so Bd naïve *R. boylii* juveniles were located in the area where the density of alternate hosts was increasing as the result of the drought. In recent drought years, bullfrogs expanded their range at the Alameda Creek site, providing a Bd reservoir host species where previously there had been none. Although it has been suggested that *Hyliola* (*Pseudacris*) species may act as a Bd vector and reservoir in California (Padgett-Flohr and Hopkins 2009, Reeder et al. 2012), Bd prevalence and load were lower in *Hyliola regilla* than in the bullfrogs observed in this study (Fig. 4). Moreover, *H. regilla* (which is terrestrial for part of its life history) and *R. boylii* share the same stream channel habitat less frequently compared to *R. boylii* and bullfrogs, so transmission opportunities between *R. boylii* and *H. regilla* are fewer at this site.

In addition to their role as Bd vectors (Greenspan et al. 2012, Schloegel et al. 2012), bullfrogs may also increase native ranids' susceptibility to Bd by decreasing their fitness in other ways. In mesocosm experiments, both *Rana draytonii* tadpoles (Kiesecker and Blaustein 1998) and *R. boylii* tadpoles (Kupferberg 1997) had increased time to metamorphosis and decreased mass when housed with bullfrog tadpoles and/or adults, presumably because of shifts in behavior, habitat use, and resource availability. Such stresses can act synergistically to increase Bd susceptibility in sympatric species.

The male effect

Our observation that Bd prevalence is higher in *R. boylii* males than in either females or juveniles could be caused by behavioral or physiological factors. Several behaviors observed in *R. boylii* males may increase opportunities for Bd transmission, therefore increasing the likelihood that they will be infected with Bd. For example, adult male *R. boylii* frequently engage in aggressive wrestling behavior, likely induced by calling activity (Wheeler and Welsh 2008, Murphy et al. 2011). *Rana boylii* is a prolonged breeder (i.e., breeding occurs over a period of greater than one month), as indicated by their male-biased daily operational sex ratio (Wheeler and Welsh 2008). At breeding sites, *R. boylii* males will congregate

and stay in the water for extended periods, while females arrive at different times throughout the breeding season (Wheeler and Welsh 2008), so the higher incidence of Bd infection observed in males in this study could be due to higher rates of contact with each other and with the water, which Bd needs to survive (Johnson et al. 2003). A similar trend has been observed in Boreal toad (*Anaxyrus boreas boreas*) populations in Colorado, United States, wherein males in chytridiomycosis-infected populations have much lower survival rates than adult females (Carey et al. 2006).

In addition to behavior, physiological factors such as testosterone and other sex hormones can lead to higher parasite loads in male amphibians. For example, the prevalence and intensity of macroparasite infections are generally higher in males than in females, owing to the relationship between sex hormones and immune function (Klein 2004). In addition, testosterone may play an immunosuppressive role in amphibians as it does in mammals and birds; in one study, higher Ranavirus titers were associated with higher testosterone levels in males (Crespi et al. 2015).

Our observations that both bullfrog presence and sex influence Bd presence in *R. boylii* may be multiplicative, although we did not find strong statistical evidence for this interaction in either of the *R. boylii* models (Appendix S1: Tables S2, S3). *Rana boylii* frequently amplex bullfrogs in an attempt to breed where the species are sympatric (S. J. Kupferberg and S. Bobzien, *personal observations*, Fig. 8, Lind et al. 2003), suggesting that *R. boylii* males may experience direct Bd transmission from contact with bullfrog reservoir hosts. In addition, Bd-infected bullfrogs have been observed shedding more infective zoospores than other native western species (Peterson and McKenzie 2014).

Batrachochytrium dendrobatidis itself may alter male host behavior to increase opportunities for transmission or increase reproductive investment in infected males that have a shorter lifespan due to chytridiomycosis infection (Chatfield et al. 2013, An and Waldman 2016). In Alameda Creek after the Bd outbreak, young-of-last-year males were observed amplexing other males during the day, behaviors not seen in the prior 19 yr (S. J. Kupferberg, *personal observation*), suggesting that Bd infection status may influence this behavior if such a causative mechanism exists.

Fig. 8. Male foothill yellow-legged frog (*Rana boylii*; 51 mm snout-urostyle length) in amplexus with a nonnative American bullfrog (*Rana catesbeiana*) at the site of the 2013 chytridiomycosis die-off in Alameda Creek. Photo credit: Steve Bobzien.

Density

Our finding that Bd loads in *R. boylii* increase with increasing density of *R. boylii* clutches within 50 m of a Bd sampling site (i.e., individual frog location) is consistent with the hypothesis that Bd transmission is density dependent (Briggs et al. 2005, 2010). Large increases in Bd prevalence have been observed during the breeding season of aggregate breeding species (Kinney et al. 2011), likely related to this density dependence phenomenon (Brannelly et al. 2015). *Rana boylii* density at the 2013 die-off site may have increased as a result of the drought on two spatial and temporal scales. First, over the course of the drought, the number of frogs breeding and laying eggs increased in the vicinity. Second, within a given breeding season, the drought caused individual pools to become isolated with little surface flow, likely allowing Bd's infective zoospore stage to increase in the shrinking pools. The bedrock lithology of the steepest part of Study Reach 3 (Fig. 1), where we observed very high Bd loads, forces subsurface flows above ground, so the area remains wetted when the channel dries out upstream. Therefore, by creating a refuge for frogs during the drought, the canyon morphology of this reach may have also created a refuge for Bd.

Rana boylii population trajectories through 2010 indicate that historically the more dense populations occurred upstream in the unregulated

reaches (Kupferberg et al. 2012), but since the drought began, trends have reversed. The perennial reach of Alameda Creek, which remained wet because of discharge from Calaveras Reservoir, and the perennial reach of Arroyo Hondo, which drains a large watershed and flows into Calaveras Reservoir, provide refugia for *R. boylii* but also expose them to increased risk because bullfrogs can thrive there. The potential indirect negative effects of bullfrogs as Bd reservoir hosts, which our results suggest can be added to their well-documented direct effects on native amphibians as predators (Kats and Ferrer 2003).

Flow regulation

Globally, flow regulation can cause a plethora of environmental problems, and the influence of dams and diversions on invasive species and pathogens is not unique to the system in this study. When stream or river flow is manipulated, it can create complex cascades of indirect effects on disease outcomes (Ong et al. 2016). Fish can be more susceptible to parasites in regulated systems, especially when dams increase abundance of an alternate reservoir host (Bartholomew et al. 2007), but ours is the first study that we are aware of to recognize the potential for indirect effects of flow regulation on Bd outcome for native amphibians. Non-native species proliferate when flow regulation creates habitat similar to their native ranges (Rahel 2002, Lobos and Jaksic 2005), especially when ephemeral lotic systems become permanent lentic ones. In California's rivers, habitat conversion and diminution of winter flooding (due to dams and inter-annual variation in precipitation as shown in Fig. 2B) promote persistence and expansion of bullfrog populations (Kupferberg 1997, Doubledee et al. 2003, Fuller et al. 2011). In addition, the pattern we observed of low flows assisting an advancement of the bullfrog invasion upstream is similar to a study of California fish, wherein non-native fish assemblages were favored in drought years and natives in non-drought years (Marchetti and Moyle 2001).

Conclusions

Rana boylii appears to be susceptible to the lethal consequences of chytridiomycosis in the field, and flow regulation, drought, invasive bullfrogs, and Bd may be acting synergistically to impact *R. boylii* populations in this system. During extreme drought, when the reach downstream of the dam remained wet, while other reaches went dry, a 20-yr pattern of higher *R. boylii* densities in unregulated reaches was reversed (Fig. 2A). Because loss of the young-of-the-year cohort (e.g., scouring of eggs after ill-timed dam releases) has been associated with subsequent declines of *R. boylii* in this and other rivers (Kupferberg et al. 2012), we anticipate that the effects of chytridiomycosis-induced mortality on recent metamorphs may have a time-lagged impact on the population that survived the drought. Furthermore, shifts to epizootic states among populations in space and time can cause mortality with population-level consequences even after Bd has reached a state of endemism (Briggs et al. 2010, Pilliod et al. 2010, Piovia-Scott et al. 2015), so a greater understanding of the biotic and abiotic factors that affect Bd outcome is critical. Our findings highlight the importance of implementing management actions (e.g., eradicating bullfrogs, mimicking the natural disturbance regime) that increase resilience in declining wildlife populations that are threatened by flow regulation, climate change, invasive species, and disease.

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Supporting Information

Additional Supporting Information may be found online at: http://onlinelibrary.wiley.com/doi/10.1002/ecs2.1740/full

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Assembly
California Legislature

TODD GLORIA
ASSEMBLYMEMBER, SEVENTY-EIGHTH DISTRICT

March 24, 2017

Eric Sklar, President
California Fish and Game Commission
C/O Valerie Termini
1416 9th Street, Suite 1320
Sacramento, CA 95814

Dear Mr. Sklar,

I am writing in support of Petition 2016-031 regarding consideration of a process to permit ferret ownership in California, which will be considered by the California Fish and Game Commission on April 26, 2017. The petition was submitted by Mr. Pat Wright on behalf of Ferrets Anonymous, an organization founded in my district.

The petition requests that the California Fish and Game Commission authorize individual permits for domestic male ferrets that have been neutered and have been vaccinated for rabies. The petition also suggests that a permit fee be established to provide for cost recovery of the program expenses.

It has been estimated that tens of thousands of Californians currently keep domesticated ferrets as pets. By providing a process for legal ownership that eliminates the possibility of feral colonies being established, and requires ferrets to be vaccinated against dangerous diseases such as rabies, the Department of Fish and Game would establish greater regulatory control while allowing ferret owners to legally and openly enjoy their pets.

The responsible ferret community in California deserves a respite from the fear of having their pets seized and destroyed. By authorizing such a process, the Fish and Game Commission would enable Californians the same ability to keep domesticated ferrets that is enjoyed in 48 other states.

I appreciate your consideration of this matter. Please do not hesitate to contact me if I can provide any additional information.

Sincerely,

TODD GLORIA
Assemblymember, 78th District

LegalizeFerrets.org
PO Box 1480
La Mesa, CA 91944
619-303-0645
CLIFFNotes@legalizeferrets.org

April 5th, 2017

Erin Chappell
Wildlife Advisor
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Hello Erin,

We are very excited and hopeful as the Commission prepares to consider our request for them to once again issue permits for ferrets as they did prior to 1985 for neutered male ferrets. Of course, this time around we are hoping to sterilized female ferrets will be included as well.

Enclosed please find our "Open Letter." To the Fish and Game Commission regarding domestic ferrets in California. Multiple copies are included in hopes you will pass it around. Perhaps I went a little overboard but after 24 years of working on ferret legalization I have a ton of information and it was difficult to put this simple matter into one letter.

Also, please find a notebook with letters from every state in the Union and for some reason a few Canadian provinces. Dr Geo Graening asked each state "Are there any instances of domesticated ferrets killing or harassing wildlife in your state?" Each state answered either "No" or "Don't know." This was included on a CD he submitted with his Final Report.

Lastly, please find a letter of support from Assemblyman Todd Gloria for this petition. For some reason he mentions only neutered male ferrets, but we'll take this letter and try to get one from the other members of the Water, Parks and Wildlife.

According to an email I received from your office, our petition is most likely to come up on Wednesday, April 26th. Can you please confirm that and let us know if there is a particular time we need to be there?

As always, thanks for your help.

Pat Wright
LegalizeFerrets.org

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TODD GLORIA
ASSEMBLYMEMBER, SEVENTY-EIGHTH DISTRICT

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Sincerely,

TODD GLORIA
Assemblymember, 78th District

AN **OPEN LETTER** TO THE **CALIFORNIA FISH AND GAME COMMISSION** REGARDING

Domestic Ferrets in California

The ferret issue has been going on in California for a long time.

While residents in **48 states are enjoying legal ferret ownership**, California is locked in a **ferret ban**.

Fish and Game controls ferrets because they can label **ANY ANIMAL** as "**wild**" – even when scientifically invalid.

OUR PETITION SIMPLY REQUESTS

that the Fish and Game Commission issue ferret permits, each at a cost of $100 or more, for pet ferrets that are sterilized and current on rabies vaccination.

This is something the Commission can do without any changes in regulation.

2118. It is unlawful to import, transport, possess, or release alive into this state, except under a revocable, nontransferable permit as provided in this chapter and the regulations pertaining thereto, any wild animal of the following species: ...all members of the Mustelidae family... ferrets!

There were two objections recently stated by Fish and Game Staff to removing ferrets from the prohibited species list:

#1 Staff recommends denying the petition. Given that the proposed action would effectively eliminate the Commission's authority to regulate ferrets,...

By issuing permits, the Fish and Game Commission will maintain its jurisdiction. Ferrets are the only domesticated animal on the prohibited species list, classified as a wild animal simply for being a member of the Mustelidae family.

#2 Regarding potential impacts to wildlife populations, the report finds that while the establishment of feral colonies is highly improbable, there is a remote possibility that escaped ferrets might do significant damage to wildlife...

We have letters on file from all 50 states responding to: *"Are there any instances of domesticated ferrets killing or harassing wildlife in your state?"* Everyone answered *"No"* or *"Don't know"* – not one *"Yes"*!

Ferrets are the only domesticated animal on the prohibited species list, classified as a wild animal simply for being a member of the Mustelidae family.

This is the explanation I received from the Legislative Analyst's Office

LAO Legislative Analyst's Office
The California Legislature's Nonpartisan Fiscal and Policy Advisor

From: Favorini-Csorba, Anton [mailto:Anton.Favorini-Csorba@LAO.CA.GOV]
Sent: Monday, April 02, 2012 9:48 AM
To: cliffnotes@legalizeferrets.org
Subject: Inquiry with LAO

Hi Pat,

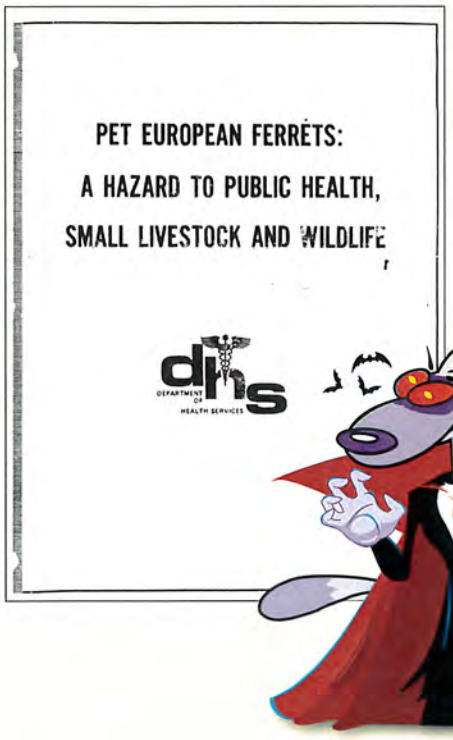
My name is Anton Favorini-Csorba and I'm the analyst with the Legislative Analyst's Office with responsibility over the wildlife policy area. We received an inquiry from you on the Fish and Game Commission's authority to regulate domestic animals, specifically as it pertains to ferrets. In general, the Commission and the Department of Fish and Game have relatively broad authority to regulate the importing and possession of non-native species, and so that extends to ferrets. Regarding your specific question about domestic animals, it's my understanding that currently ferrets are considered wild animals under state law. Fish and Game Code section 2118(b) lists animals of the families Viverridae and Mustelidae as restricted, and I believe ferrets fall into the latter. Furthermore, the Commission is the body that determines whether an animal is wild or not because the Commission is charged with determining whether an animal is "normally domesticated in this state," (FGC section 2116). So that would indicate to me that the Legislature has declared its intent on the Commission's authority.

Hopefully that answers your question, although I realize it may not be the answer you were looking for.

Best,
Anton Favorini-Csorba
Fiscal & Policy Analyst
Water, Agriculture, and Wildlife
Legislative Analyst's Office

Is it fair that the agency that issues hunting and fishing licenses is charged with regulating a cute, furry PET? We have very little common ground here. Ferrets are domestic animals and should be regulated by the Department of Agriculture as are dogs and cats. *How would California hunters respond if their permits were issued by PETA?*

Officials from these three state agencies have gone through considerable expense to produce "reports" to back up their position. Most notably are these two reports. **They have one thing in common: Begin with the position that ferrets pose various threats and work backwards.** Neither has been peer reviewed and both are **significantly lacking in documentation.**



PET EUROPEAN FERRETS: A HAZARD TO PUBLIC HEALTH, SMALL LIVESTOCK AND WILDLIFE

1988

Denny G Constantine, Public Health Veterinarian for the State of California and the foremost authority on bats and public health. Kenneth Kizer, Director, California Department of Health Services. Published December 1988.

From the Executive Summary:

Ferret play frequently assumes the form of mock attacks, which may result in bites to humans. Serious bites may occur, especially if the animal is surprised or angered. Adults are able to quickly terminate such encounters, and thereby limit injury. However, infants, who often seem to be perceived by ferrets as prey, may suffer severe injury as a result of ferret attacks. Indeed, ferrets sometimes unleash frenzied, rapid-fire bite and slash attacks on infants, usually on their heads and throats, and sometimes inflict hundreds of bites. The animals have been reported to then drink the victim's blood and eat the shredded tissues.

Proceedings of the Sixteenth Vertebrate Pest Conference : THE EUROPEAN FERRET, MUSTELA PUTORIUS, (FAMILY MUSTELIDAE) ITS PUBLIC HEALTH, WILDLIFE AND AGRICULTURAL SIGNIFICANCE

1994

Jim C. Hitchcock, California Department of Health Services, Vector-borne Disease Section, Ontario, California 91764.

Abstract:

The European ferret, Mustela putorius, a species prohibited in California, has become increasingly popular as a household "pet." As a result, its threat to public health, wildlife and agriculture has markedly increased. There has also been a consequent increase in reported attacks on humans, especially infants, including several fatalities.

Reports of rabid European ferrets are also on the increase. When European ferrets establish "feral" populations, domestic poultry, waterfowl, game birds, rabbits and other species are at substantial risk. At this time, a California

Proc. 16th Vertebr. PestConf. (W.S. Halverson& A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. 1994.

Ferret proponents have been working toward legalization since about 1988.

2004

Several bills have been through the legislature. The last one, SB84 (Dede Alpert) passed– but was vetoed by Governor Schwarzenegger.

"I love ferrets," Schwarzenegger wrote in his veto message to the California State Senate. "I co-starred with a ferret in Kindergarten Cop. However... I am concerned that there has not been proper study to determine whether ferrets are detrimental to the health and safety of California citizens and the environment."

Most recently, the Fish and Game Commission **rejected** a petition for regulation change to remove ferrets from the **prohibited species** list.

Ferrets as Wild Animals?

§2116. Wild Animal As used in this chapter, "wild animal" means any animal of the class Aves (birds), class Mammalia (mammals), class Amphibia (frogs, toads, salamanders), class Osteichtyes (bony fishes), class Monorhina (lampreys), class Reptilia (reptiles), class Crustacea (crayfish), or class Gastropoda (slugs, snails) which is not normally domesticated in this state as determined by the commission.

Everyone knows domestic ferrets aren't wild animals.

What we don't know is when the Fish and Game Commission ruled that ferrets are not normally domesticated in this state.

We are being UNFAIRLY penalized because ferrets ARE domestic animals.

LegalizeFerrets.org
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CALIFORNIA FISH AND GAME COMMISSION
DECISION LIST FOR NON-MARINE NON-REGULATORY REQUESTS THROUGH FEB 9, 2017
Revised 04-11-2017

FGC - California Fish and Game Commission **DFW** - California Department of Fish and Wildlife **WRC** - Wildlife Resources Committee **MRC** - Marine Resources Committee

Date Received	Name of Petitioner	Subject of Request	Short Description	Staff Recommendation	FGC Decision
1/17/2017	Kevin Ward	Out of state hunting	Request FGC authorize permits to bring mountain lion products into California from mountain lions legally harvested in another state.	**Deny; outside FGC authority. Requires legislative change to Fish and Game Code Section 4800(b)(1).**	RECEIPT: 2/8-9/2017 **ACTION: Scheduled 4/26-27/2017**
2/8/2017	Eric Mills	Hunting and fishing	(1) Requests FGC discuss a ban on robo-ducks, and (2) Requests a ban on lead fishing tackle	**(1) Deny; analyzed in 2017 draft environmental document for waterfowl hunting and no new biological information presented to indicate a change is warranted, and** **(2) Deny; regulatory requests must be submitted using the regulation change petition form, FGC-1.**	RECEIPT: 2/8-9/2017 **ACTION: Scheduled 4/26-27/2017**
2/8/2017	Marilyn Jasper	FGC meeting procedures	Requests FGC consider changes in public noticing and comment deadline processes. Specifically: (1) post meeting materials 72 hours before the written comment deadline, and (2) extend the late comment deadline.	**(1) Deny; meeting materials prepared for commissioners currently include public comments received by the written comment deadline and could not be incorporated if the materials were posted before the deadline, and** **(2) Deny; regulation change requests must be submitted using the regulation change petition form, FGC-1.**	RECEIPT: 2/8-9/2017 **ACTION: Scheduled 4/26-27/2017**

From: Kevin Ward
Sent: Tuesday, January 17, 2017 8:23 PM
To: FGC
Subject: Re: Reminder about marine and non-marine days for 2017

I would like to propose a change in our California law so that it would be legal for a California resident to go to some other state, legally harvest a mountain lion, have a fur, rug, or taxidermy mount made of it and then be able to bring it back into California. Right now a California hunter can go out of state and harvest other animals that are not legal to hunt in California and/or harvest a larger number of some animals that are legal in California, and we can legally bring them back into California. Why should the mountain lion be any different. As long as the animal is legally harvested in any other state in the United States of America it should be legal to at least harvest it and bring it back into the state of California. How do I make that happen? Thank you. Kevin Ward

State of California – Fish and Game Commission
PETITION TO THE CALIFORNIA FISH AND GAME COMMISSION FOR REGULATION CHANGE
FGC 1 (NEW 10/23/14) Page 1 of 3

2015-008

Tracking Number: (Click here to enter text.)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
   Name of primary contact person: Paula Lane Action Network (PLAN), Susan Kirks, Badger Ecologist

2. **Rulemaking Authority (Required)** - Reference to the statutory or constitutional authority of the Commission to take the action requested: Mammal Hunting 2015-2016 Regulations

3. **Overview (Required) -** Summarize the proposed changes to regulations: Repeal allowed hunting of American Badger and Gray Fox. American Badger is a Species of Concern in California since 1987 with diminishing populations and significant fragmentation of and loss of habitat.

4. **Rationale (Required) -** Describe the problem and the reason for the proposed change: Special Status Animals should not be allowed to be hunted in California. In particular, the American Badger is a CA Species of Concern. Population is diminishing and habitat areas have increasingly diminished and fragmentation prevents habitat access as well as movement for mating to sustain biodiversity. The American Badger also creates benefits for other wildlife in coastal and inland ecosystems. Hunting of this fur-bearing mammal (as well as Gray Fox) should be permanently repealed. Please see attached summary.

SECTION II: Optional Information

5. **Date of Petition: November 28, 2015**

6. **Category of Proposed Change**
   ☐ Sport Fishing

☐ Commercial Fishing
☒ Hunting
☐ Other, please specify: Click here to enter text.

7. The proposal is to: (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)
☐ Amend Title 14 Section(s):Click here to enter text.
☐ Add New Title 14 Section(s): Click here to enter text.
☒ Repeal Title 14 Section(s): Mammal Hunting Regulations, Subdivision 2 Game, Furbearers, Nongame and Depredators (Detail Listing). Chapter 5 Furbearing Mammals. **§461. Badger and Gray Fox.** (a) Badger may be taken as follows: (1) Season and Area: November 16 through the last day of February, statewide. (2) Bag and Possession Limit: No limit. (b) Gray fox may be taken as follows: (1) Season and Area: November 24 through the last day of February, statewide. (2) Bag and Possession Limit: No limit. (3) Dogs may be permitted to pursue gray fox in the course of breaking, training, or practicing dogs in accordance with the provisions of Section 265 of these regulations. *Repealer and new section filed 5-13-81; designated effective 5-23-81.*

8. If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition Click here to enter text.
Or ☒ Not applicable.

9. Effective date: If applicable, identify the desired effective date of the regulation.
If the proposed change requires immediate implementation, explain the nature of the emergency: Request expedient review and implementation of repeal for hunting Badger and Gray Fox immediately.

10. Supporting documentation: Identify and attach to the petition any information supporting the proposal including data, reports and other documents: See attached summary.

11. Economic or Fiscal Impacts: Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: None.

12. Forms: If applicable, list any forms to be created, amended or repealed:
Click here to enter text.

RECEIVED
2015 DEC -2 AM 9:03
CALIFORNIA
FISH AND GAME
COMMISSION

SECTION 3: FGC Staff Only

Date received: Click here to enter text.

FGC staff action:
☐ Accept - complete
☐ Reject - incomplete
☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: _____

Meeting date for FGC consideration: _____

FGC action:

- ☐ Denied by FGC
- ☐ Denied - same as petition _____
  Tracking Number
- ☐ Granted for consideration of regulation change

Request to Repeal Hunting of American Badger and Gray Fox

The American Badger (*Taxidea taxus*) has been a designated Special Status Animal, a CA Species of Concern, since 1987, for over 28 years. The CA Department of Fish and Wildlife defines Species of Concern as:

"A Species of Special Concern (SSC) is a species, subspecies, or distinct population of an animal* native to California that currently satisfies one or more of the following (not necessarily mutually exclusive) criteria:

- is extirpated from the State or, in the case of birds, in its primary seasonal or breeding role;
- is listed as Federally-, but not State-, threatened or endangered; meets the State definition of threatened or endangered but has not formally been listed;
- is experiencing, or formerly experienced, serious (noncyclical) population declines or range retractions (not reversed) that, if continued or resumed, could qualify it for State threatened or endangered status;
- has naturally small populations exhibiting high susceptibility to risk from any factor(s), that if realized, could lead to declines that would qualify it for State threatened or endangered status."

The 3rd and 4th points of this description directly relate to American Badger (Taxidea taxus) in California.

A Special Status animal, a CA Species of Concern, should not be on the CA Department of Fish and Wildlife's permitted Hunting list. We respectfully request the Department repeal this regulation at your earliest convenience.

Discussion

The conservation nonprofit organization, Paula Lane Action Network (PLAN) in Sonoma County, formed in 2000 and incorporated in 2004, has for 15 years dedicated resources and time to observe and document American Badger in the San Francisco Bay area, protect identified longstanding American Badger habitat, and establish outreach in California and outside California, to better understand this reclusive mammal. The conservation effort includes documenting all available habitat, species sightings, and relating seasonal behaviors to this work. By seasonal behaviors, we mean, for example, observing burrowing and foraging patterns June through August for evidence of increased activity related to dispersal of juvenile badgers. Or from February through Summer, observing Badger activity on properties to identify and confirm preferred territories of adult female Badgers. In fact, one of the most salient factors in the potential preservation of the species in California and possibly elsewhere, is identifying preferred adult female Badger territories and ensuring non-encroachment and protection of those areas. Coupled with this is the protection of wildlife movement areas to ensure the ability of traversal by male adult Badgers and movement of all Badgers through preferred wildlife corridors, to help sustain biodiversity. Added to this is the pressing need for prey and water availability during the current drought, which has been observed to negatively impact American Badger and other wildlife species, making competition for both resources heightened.

The nonprofit, Paula Lane Action Network, has a Naturalist and Badger ecologist who has visited every available identified property and habitat, with repeat visits over seasonal time periods, in the San Francisco Bay area during these 15 years, to receive reports, discuss sightings and any questions with property owners or residents, and verify reports received of habitat and/or species sightings. The naturalist and badger ecologist has also fielded questions and responded to inquiries in California and outside California. A significant field-study-based body of knowledge about American Badger has resulted from this level of attention to the species.

In the greater San Francisco Bay Area, there are estimated to be a population of 15 adult badgers and possibly 5 remaining living juvenile Badgers from the 2015 birthing season. In Sonoma and Marin Counties, in Summer 2015, two adult Badgers were documented as killed by motor vehicle strikes and 2 juvenile Badgers were also documented as killed by motor vehicle strikes. Death by vehicle strike, especially in Summer months, from 2011 to present, as reported to PLAN and confirmed, is consistent, 2-4 Badgers annually.

American Badger relies on grassland, including agricultural areas, for habitat and foraging. Badgers succumb to mortality from ranchers who believe a badger burrow or foraged out gopher mounds on a property will result in livestock stepping in holes and breaking legs, thus a loss of potential income source for the rancher. American Badger poses no threat to ranchers or farmers. Preferred prey of American Badger of gopher, vole, mouse, and ground squirrel follow a pattern of underground prey tunnels aerating soil in grassland areas, but also partaking of available grasses and vegetation. American Badger is a natural manager of gopher, vole, mouse and ground squirrel in grassland and adjacent areas. American Badger burrow creation occurs from foraged out prey holes. The burrow is usually in a hillside and the hole itself is created on a diagonal angle with a large area of displaced soil outside the burrow opening. Unless a herd of animals is panicked and fleeing a perceived threat, thus increasing the likelihood for an accident of any kind, the possibility of a domestic large animal stepping into and then down into a Badger Burrow opening is extremely low. Direct observation of horses galloping on a hillside among 15 active Badger burrows contributes to this clarification of what is a non-threat to livestock. Foraged out gopher mounds or vole holes are also similar in size to any general small or medium hole in a grassland area and livestock have not in 15 years of multiple observations been observed to inadvertently step into such a hole. In addition, a Marin County rancher who raises cattle and sheep on a 300+ acre ranch has over time observed his bull to intentionally step into a foraged out prey hole and kick up dirt from the loosened soil onto its body to alleviate itching, and then move along its way. Direct observation over an extended period of time allows this factual clarification to offset the cultural myth of rancher and farmer dislike of American Badger on a grassland property. While American Badger generally will remain within its home range, often from necessity due to obstructed movement areas and fragmented habitat, and return to preferred areas for prey foraging, the adult female Badger selects and remains in her territory, and male adult Badgers traverse through established female Badger territories. On farms and ranches comprised of grassland, a permanent Badger in residence is unusual and any concern about a Badger burrow created on a private property could be followed by filling in the hole with dirt after an adult Badger has foraged, obtained prey, also managing the gopher, vole, mouse or ground squirrel population, and has moved on to another area in the Badger's home range. The average length of time for an adult Badger to remain in an area, foraging, is generally a week to ten days, based on direct observation.

Sonoma and Marin Counties are recorded to have a small sustaining Badger population in the coastal area and, to the degree badgers can move and range, further inland in the Occidental, Petaluma and Sonoma Valley areas in grassland with gopher/vole/mouse prey base. Petaluma in southern Sonoma County, comprised of fairly expansive grassland, has a documented American Badger presence of longstanding, over 100 years (Habitat Survey, 2003, Fitts). Nicasio in Marin County also has documented American Badger activity, with two additional reports of Badger activity in southern/mid Marin and one report in northern Marin County. In Napa County, where grassland habitat does exist, but the vineyard properties abound, there appears to be one adult female Badger and possibly one or two adult male Badgers. The East San Francisco Bay area included reports as of 2015 of one adult female Badger in the Dublin area in Summer with one to two juvenile Badgers dispersing and living, seeking water and prey, in Summer 2015. Thus, at least one adult male Badger has also been in residence in the East Bay Hills. The available land to sustain a Badger population in the East Bay is questionable.

South of the San Francisco Bay Area in Santa Clara County and Santa Cruz County are reports of one to three adult Badgers sustaining, with an unknown variant of the number of female adult Badgers in this population as of 2015.

The Central Valley area, particularly Sacramento agricultural land, has a reported small badger population via reports and questions posed to the nonprofit PLAN. The southern California area of Monterey has had documented a population of 7 adult Badgers in the mid-2000s. The current population in the Monterey area is unknown.

In Mendocino County's coastal area, reports of one juvenile badger and one adult Badger were been received in 2014 and 2015.

Negative impacts contributing to diminution in American Badger population and ability to survive include:

-First and foremost, habitat loss and habitat fragmentation. As a Species of Concern in California, habitat and assured movement areas for badger are not protected. Mitigations for development and other impacts relate to direct harm to the species and our past experience reflects the Department's lack of understanding of species needs and behaviors when regulators become involved in reviewing and approving mitigations related to loss of habitat from development or other causes requiring consideration for mitigation. Accrual of observations and data by PLAN over 15 years reflect significant loss of habitat and prey bases and a clear need to ensure habitat areas, preferred adult female Badger habitat, and the ability for American badger to range or move be identified and actively preserved.

-Additional significant negative impacts to the remaining American Badger in California include drought. Less prey available and dried-up Summer and Autumn water sources result in competition for both.

-Motor vehicle strikes killing adult and juvenile badgers especially during critical Summer months for dispersal of young.

Dr. Jessie Quinn's research and subsequent dissertation in the late 2000s documented a movement range in the Monterey area for a population of 10 badgers of approximately 10 miles. In the San Francisco Bay area, the movement range for American Badger is directly observed over 15 years for the documented small badger populations to be only 4 to 6 miles on the Sonoma Coast, 4 miles on the Marin Coast (with development in between coastal areas preventing contiguous corridor movement) and approximately 8 miles coast-inland-coast, but *only if* conditions allowing movement, not being killed by ranchers who own the agricultural lands, and sufficient prey and water are available. A more realistic inland movement area for American Badger in Sonoma County is 6 miles and in Marin County is 5 miles.

Because there do not appear to be other dedicated broad-scale efforts to discern factual information about this Species of Concern and the observation of diminished and fragmented habitat along with mortality rates, even if the American Badger were not listed as a Special Status animal, the species should be removed from the Department's Hunting list. As a Species of Concern, the American Badger should not have ever been on the Hunting list (this includes trapping as a method for killing). Of note, in addition, is the allowed Hunting season is during mating season and early birthing season for the American Badger.

It is likely the level of knowledge about American Badger is in-depth in the San Francisco Bay Area because of the nonprofit organization's (PLAN) dedicated observation and research over 15 years. This observation and research continue. While educational outreach also continues, including dispelling cultural myths and understanding the significant benefit of the remaining Badger population to coastal and inland ecosystems, serious concerns exist related to continued fragmented and diminishing habitat and negative impacts to the species described above. Without a Threatened status designation, unquestionably, the habitat areas for American Badger will continue to be negatively impacted and diminish. This, coupled with drought and intentional killing, are of severe concern.

Gray Fox

Gray Fox is also listed in the described regulation under question. Grey Fox is a native mammal to California and, while data collection and observations of the conservation nonprofit, PLAN, relate specifically to American Badger, Gray Fox is requested to also be removed from the Hunting list of the CA Department of Fish and Wildlife as a native mammal who relies on similar movement areas, similar prey, similar habitat areas as American Badger, with negative impacts from diminishing habitat and drought-related challenges.

How many Badgers remain in California? The exact quantity is unknown. In the entire San Francisco Bay Area grassland habitat areas, we estimate under 30 Badgers. Sustaining biodiversity is challenging because of fragmented habitat areas and obstructed movement corridors. The mortality rate for vehicle strike deaths annually appears to average between 2 and 4 badgers, adult and juvenile. This has been consistently observed over 12 years. Identifying preferred female adult Badger territory areas is critical to support sustenance of Badgers that remain. However, without open movement areas, sufficient prey and water, male adult Badgers are challenged to enter a female adult Badger's territory and successfully mate. Although some publicly protected lands such as a national park (Pt. Reyes National Seashore) or public open space grassland area are preserved with no possibility for development, the necessity of connection to agricultural lands and open grassland to these areas, and prevention of obstruction of wildlife corridors as well as further loss of prey base areas, make the critical nature of preserving wildlife corridors and habitat for American Badger more urgent.

It is imperative to take every action in an attempt to allow the small American Badger population of adults and juveniles in California to sustain. Unquestionably, the American Badger's official status should be Threatened.

The purpose of this request is to repeal the allowed hunting of American Badger and also of Grey Fox in California as soon as possible.

Benefits to other species from American Badger presence in grassland habitat include for Burrowing Owl (also a CA Species of Concern), California Tiger Salamander, California Red-Legged Frog, and other unlisted species such as Striped Skunk and Gray Fox. The American Badger provides immense benefits to coastal and inland ecosystems.

Submitted for Paula Lane Action Network (P.L.A.N.), PO Box 2903, Petaluma, CA 94953

Tax ID#: 73-1702426.

Susan Kirks, Naturalist and Badger Ecologist

PETITION 2015-008

Comment for CA Fish and Game Commission Meeting, April 26-27, 2017

Agenda Item:

17. Non-marine petitions for regulation change and non-regulatory requests from previous meetings

(C) Update on pending regulation petitions and non-regulatory requests referred to staff and the Department for review
I. Petition #2015-008 to repeal hunting of American badger and gray fox

Submitted by Paula Lane Action Network
Susan Kirks, Naturalist
Contact: Susan Kirks, susankirks@sbcglobal.net, 707-241-5548

Thank you for the opportunity to submit this Comment. Unfortunately, the location of this meeting in southern California precludes our ability to have a representative present at the meeting to deliver the Comment.

Comment:

General and Group-Relevant:

The Predator Policy Work Group agendized and reviewed the above-referenced Petition on March 20, 2017.

I appreciated the opportunity to be present for the meeting, which included an approximately 1 hour and 20 minute discussion of the topic. PPWG Chairperson Erin Chappell also graciously accommodated my travel time and ability to attend the meeting in Sacramento on March 20, 2017.

Regarding member composition of the Predator Policy Work Group: The Group appears to be comprised of a majority of representatives from the hunting and trapping lobbies and similar advocacy groups or agencies.

A non-majority member questioned qualifications of the PPWG to review Petition 2015-008, including lack of expertise in the subject matter as well as potentially biased views related to the species. Such a statement appeared to reflect a reasonable viewpoint of unbiased review of the Petition.

This is a salient point that Fish and Game Commissioners are requested to consider.

In addition, because Petition 2015-008 relates to regulatory hunting issues as well as raises questions of the significance of understanding accurate species information and conservation needs, which may lead to additional questions and recommendations, the special interests reflected in membership of the PPWG should be evaluated with an apparent identified bias in mind.

While I appreciated the opportunity to proactively provide supportive information for Petition 2015-008 during this meeting, a fundamental question from our nonprofit organization and from me is:

Why is there not an equal number of conservation-oriented members and hunting/trapping lobbyist members of the Predator Policy Work Group? The Commission has appeared to request of this Group consensus-based input on recommendations related to review of Predator Policy and Regulations. It appears a most reasonable approach would be to ensure an equal number of representatives from hunting/trapping interests and conservation interests comprise this Group. Is it possible there is such a balance and several members were absent from the meeting on March 20th?

Next, regarding the Policy and Regulation review by the PPWG, two substantive views from each perspective would appear to be relevant in examining questions and regulation changes. These viewpoints should be documented and provided to the Commission in summary for review. The Commission appears to have requested the PPWG provide consensus based information on Policy and Regulation review. However, if there is not an equal representation in terms of composition in the Group, important recommendations related to conservation, with supportive information, may not be provided to the Commission. This could be detrimental to the species under review as well as the citizens of California.

Following review of two sets of recommendations, anticipated on many of the Policy and Regulation issues, the Fish and Game Commissioners could pose additional questions, with requests, to the members of the Predator Policy Work Group. Subsequently, re-examination of issues and regulations may lead to further discussion and agreement on change, or not. For the future of California's wildlife, a deeply substantive and comprehensive review of Policy and Regulations for the subject species appears to be most functional and, ultimately, productive course for California's wildlife.

The conservation-oriented organizations and individuals should not be requested to compromise important viewpoints or experiences that may positively contribute to the process because they are outnumbered in terms of membership in the PPWG and the hunting/trapping lobbyist advocates and representatives refuse to compromise themselves.

As important, concurrent with a functional process needs to be, as the DFW staff present in a former meeting stated, an examination of how to request budgetary funding for the CA Department of Fish and Wildlife, directed toward conservation measures – for data gathering, documentation to reflect accuracy of identified wildlife populations and locations, and effective policies, especially those who are CA Species of Concern and Threatened and Endangered species.

To this end, and related to Petition 2015-008, our nonprofit recommends the following:

Specific to Petition 2015-008:

Please support the second recommendation of the Predator Policy Work Group – which is to refer the above-referenced Petition to DFW staff for review, consideration and recommendation, intact, for both species. The DFW staff present in the March 20th meeting indicated a capability to consider the Petition as presented, and to consider species individually and in combination the American Badger, a CA Species of Concern, and the Gray Fox.

In the meeting, I stated this was our preference.

In addition, please consider the Fish and Game Commission's position on seeking annual budgetary funding for conservation-based staff, policy and activities.

I and my nonprofit organization made a commitment to your DFW staff in the March 20th meeting, and again state herein our intention to communicate with, provide support for and seek to identify potential grant funding for habitat and species data gathering statewide. This is needed to update and clarify available information for American Badger and Gray Fox in California. We have a suggested framework for regional data gathering, to accrue for statewide updated information, and will actively seek funders for such a study, which should be a minimum of 3 years of data gathering.

If the Fish and Game Commission is aware of available funding sources for such a project, we would appreciate receiving those recommendations or references.

Please note, during the March 20, 2017 PPWG meeting, one of the majority group members referenced a discussion in a prior PPWG meeting, where there appeared to be a consensus among all, including DFW staff, that updated and accurate information on species is needed, beyond hunting/trapping reported data to the State of California.

While such a project is formulated and begun for American Badger and Gray Fox, with a concerted effort to obtain grant funding, which my nonprofit organization hopes to coordinate, the hunting of a CA Species of Concern since 1987, with diminishing populations and loss of habitat, should be suspended. A final recommendation related to permanent removal of American Badger from the Mammal Hunting List to continue the suspension the Fish and Game Commission has the capability to enact, would likely be forthcoming. Gray Fox is a species about whom additional data is being gathered and Petition 2015-008 supports consideration of removal of Gray Fox from the Active Mammal Hunting List, with a similar recommendation in the future for permanent removal of hunting a native species with similar impacts and conditions as American Badger (see Bill Leikam Supplemental comment for Petition).

Thank you again for the opportunity to submit this Comment for your meeting and for your consideration.

Respectfully submitted,

Susan Kirks
Susan Kirks
April 13, 2017

copy: Erin Chappell, Chairperson, PPWG

Sent via electronic mail

April 13, 2017

California Fish and Game Commission ("the Commission")
President Erick Sklar
Commissioner Jacque Hostler-Carmesin
Commissioner Burns
Commissioner Silva
Commissioner Anthony Williams
Executive Director Valerie Termini

California Fish & Wildlife Department ("the Department")
Executive Director Charles Bonham
Deputy Director of Wildlife and Fisheries Stafford Lehr

Re: PUBLIC FORUM (April 26, 2017 Commission Meeting) - Petition on Banning Night-Time Hunting and Lethal Trapping in Gray Wolf Territory (Petition #2015-010)

Dear President Sklar, Executive Director Termini, Fish & Game Commissioners, Director Bonham, and Deputy Director Lehr,

On behalf of the Center for Biological Diversity and Project Coyote ("Petitioners") and our more than 100,000 members and supporters in California, we write to (i) address and discuss several points raised by President Sklar at the February Commission meeting regarding the FGC Petition on banning night-time hunting and lethal trapping within the range of the Gray Wolf (Petition #2015-010) ("the Petition"); and (ii) respectfully urge the Commission to take concrete steps on this Petition by committing to a rulemaking schedule, as currently none is established.

As the Commission is well aware, it has been over sixteen months now since the Petition was submitted to the Commission on December 4, 2015. Yet, in spite of the Commission's intent to use the public petition process to boost transparency and decrease the public's confusion as to the status of rulemakings, Petitioners lack information as to when this Petition will be properly processed and addressed by the Commission and Department.

At the February 2017 Commission meeting, President Sklar stated that the Commission could not move forward with the Petition and would stay its processing in light of the lawsuit filed by wolf-opponents challenging the CESA listing (*California Cattlemen's Association et. al. v. California Fish and Game Commission*, 37-2017-00003866-CU-MC-CTL), and the fact that the state wolf plan had recently been released. We respectfully disagree with the reasoning for staying this Petition.

First, the recognition that the lawsuit could be prolonged over a significant period of time fuels the necessity for swift action by the Commission and Department on the Petition. A pending lawsuit does not absolve the Commission and Department of their obligation to act in the public trust and halt activities which have the significant potential to jeopardize the continued existence of a listed species.

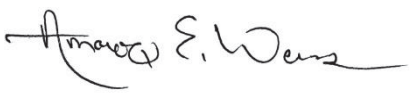
Second, the wolf plan on its face is an adaptive management document intentionally written by the Department to be subject to change whenever needed to respond to changing circumstances on the ground, new relevant science, or new regulations. The plan thus is neither an impediment nor reason for the Commission and Department to refrain from taking action to ban activities which jeopardize a listed species.

Third, and most importantly, each day the Commission delays action on the sought-after ban, each individual member of California's state-and-federally-listed wolf population is at risk of harm including death. Because wolf recovery in California is in its infancy, with only a handful of known wolves here, any such harm could jeopardize the continued existence of the species. The illegal poaching of federally protected wolves in southcentral Oregon in recent times highlights the precarious population of wolves in California.

We reiterate that precedent exists to enact a ban, as has been done to protect two other state-listed canids, the San Joaquin Valley kit fox and Sierra Nevada red fox. We also emphasize the legal liability of the Commission and Department for authorizing activities which place wolves in harm's way and for not acting to eliminate that risk by banning the activities.

Thank you for your consideration. If you have any questions, please feel free to contact us directly.

Sincerely,



Amaroq Weiss
West Coast Wolf Organizer
Center for Biological Diversity
911 Lakeville St #333
Petaluma, California 94952
(707) 779-9613
aweiss@biologicaldiversity.org

Camilla Fox
Executive Director
Project Coyote
P.O. Box 5007
Larkspur, CA 94977
(415) 945-3232
cfox@projectcoyote.org

From: Nic D
To: FGC
Subject: Protect precious wolves!
Date: Thursday, April 13, 2017 4:45:14 PM

- I am a California resident who want to see wolves fully recovered in California and therefore support a ban on lethal traps and night-time hunting of nongame and furbearer species within the range of the grey wolf.
- Mistaken killings of grey wolves recolonizing California pose an immediate risk to grey wolf recovery in California.
- Successful recovery of the grey wolf in California will require the establishment of policy that addresses human-caused killing of grey wolves, which remains a primary threat to the species.
- If the Fish and Game Commission fails to ban night-time coyote hunting and lethal trapping within range of the grey wolf in California, illegal killing of grey wolves in violation of the California Endangered Species Act and the Federal Endangered Species Act will likely result.
- As apex predators and keystone species, grey wolves are critical to healthy ecosystems. Assuring a broader recovery of wolves by banning night-time hunting and lethal trapping within their native range will benefit other native species as well as the overall integrity of the ecosystems in grey wolf range.
- Precedent exists to enact a ban, as has been done to protect two other state-listed canids: the San Joaquin Valley kit fox and Sierra Nevada red fox.
- This petition has been before the Commission for more than 16 month; it is time for the Commission and the Department to act now. There is no excuse for further delay.

Dr. Kelly Dunn

Sent from my iPhone

From:	Pat Marriott
To:	FGC
Subject:	Please protect wolves in California
Date:	Thursday, April 13, 2017 3:34:03 PM

Fish & Game Commissioners:

The grey wolf is currently protected by the California Endangered Species Act and the Federal Endangered Species Act.

I urge you to amend the CA Code of Regulations to ban

- nighttime coyote hunting
- lethal traps
- night time hunting

all within the grey wolf's range.

I want to see full recovery of these wolves, so we need to protect them from humans. The grey wolf is essential to a healthy ecosystem.

This petition has been before the Commission for over 16 months. Precedent exists for the ban. Examples are the sierra Nevada red fox and the San Joaquin Valley kit fox.

Please act now.

Thank you,

Pat Marriott,

From: Nic D
To: FGC
Subject: Trapping wildlife is barbaric!
Date: Thursday, April 13, 2017 4:46:23 PM

- A Fish and Game Code provision was added with the passage of SB 1148 (Pavley) that requires license fees be raised to cover program and implementation costs from fee-based programs yet this straightforward requirement has not yet been fully implemented for the state's fur-trapping licensing fees.
- If the Commission cannot ensure that trapping license fees are raised to a level that would realistially cover the state's trapping program implementation costs, the Commission should eliminate the fur-trapping program.
- Fewer than 100 Californians engage in commercial trapping for the fur trade. As public trustees of California's wildlife, the Commission should require licensing fees that are in line with the true cost incurred by this tiny minority of people who enjoy trapping animals for fun and profit.
- This petition has been before the Commission for more than 16 month; it is time for the Commission and the Department to act now. There is no excuse for further delay.

Dr. Kelly Dunn

Sent from my iPhone

EDWARD MACAN

January 28, 2017

California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Dear Commissioners,

In August 2015, the Commission correctly voted to end bobcat trapping in California. Unfortunately, thousands of other fur-bearing animals are still subject to cruel trapping for profit and recreation in California. Why? Because the Commission has never correctly complied with Pavley, SB 1148. It is time for the Commission to do so, shifting the costs of managing the trapping program from state taxpayers to the trappers themselves, and, if the trappers are unwilling or unable to pay these costs, entirely abolishing both commercial and recreational trapping across the state.

As you know, a Fish and Game Code provision was added with the passage of SB 1148 (Pavley) for the 2013-2014 trapping season that requires license fees be raised to cover program and implementation costs from fee-based programs. Yet the Commission has failed to comply with this straightforward requirement for four years now. We cannot stand for a fifth year of non-compliance. Trapping license fees come nowhere close to covering the actual cost of implementing the state's trapping program: the current cost of a trapping license is just $117, which is at least 15 times less than it should be to generate enough revenue to cover the cost of the fur-bearing and non-game mammal trapping program, based on publicly available information. Existing law requires that license fees be adjusted to cover the program costs of the Fish and Game Commission and the California Department of Fish and Wildlife in the management and implementation of the state's trapping program.

I therefore request that the Commission immediately end the illegal subsidy of trapping. If ending it results in a statewide ban of commercial and recreational fur trapping—which I hope it does, given its role in the worldwide fur trade that is driving so many mammals to extinction—so be it. Given that fewer than 100 Californians engage in commercial trapping for the fur trade, it is incumbent on the Commission, as public trustees of California's wildlife, to require licensing fees that are in line with the true cost incurred by this tiny minority of people who enjoy trapping animals for "fun" and profit.

Thank you for your consideration,

Sincerely,

Edward Macan