

# Extinction

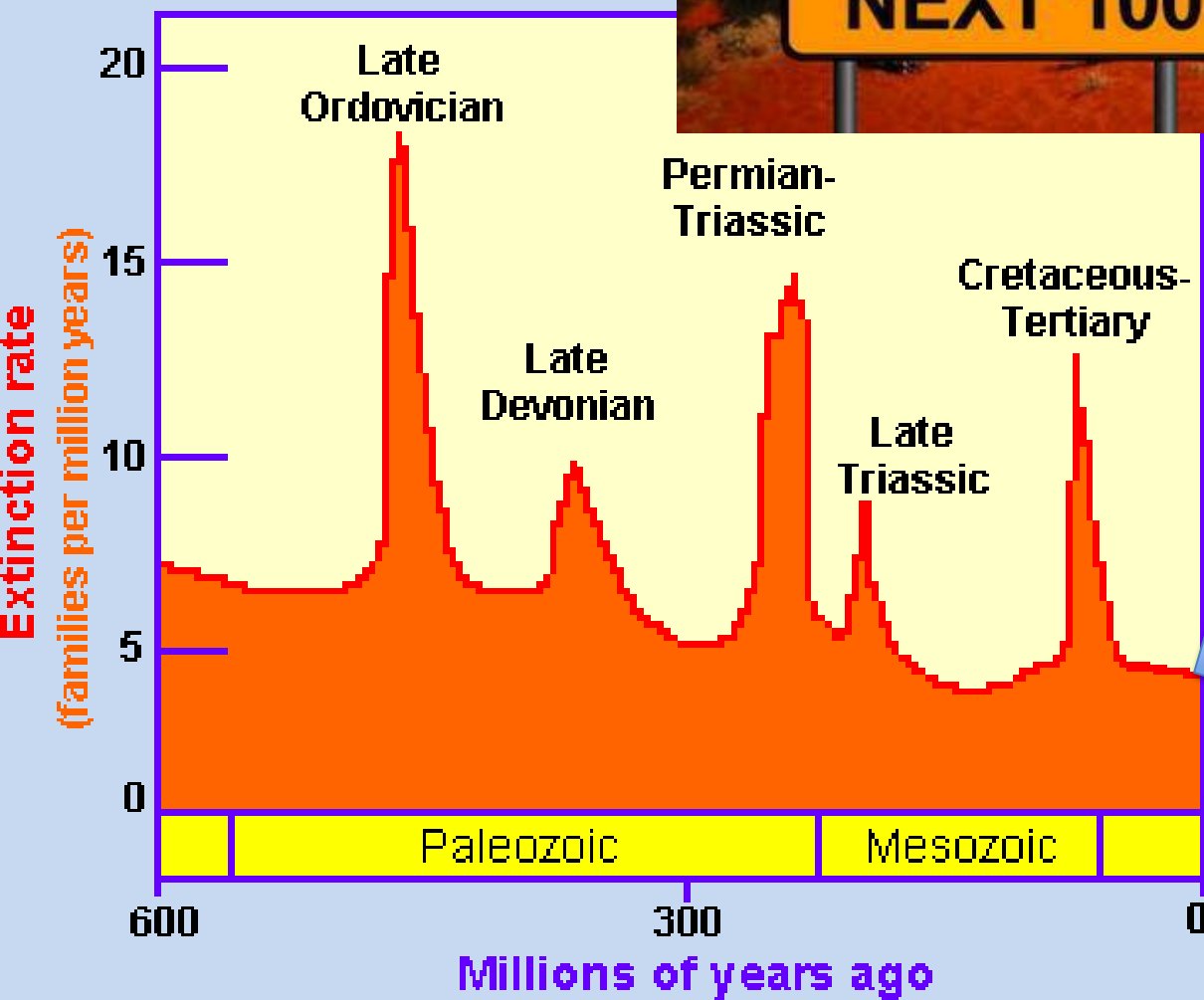
in California Fishes

Ecological, Biological, Legal, Real



Peter B Moyle

March 29, 2016



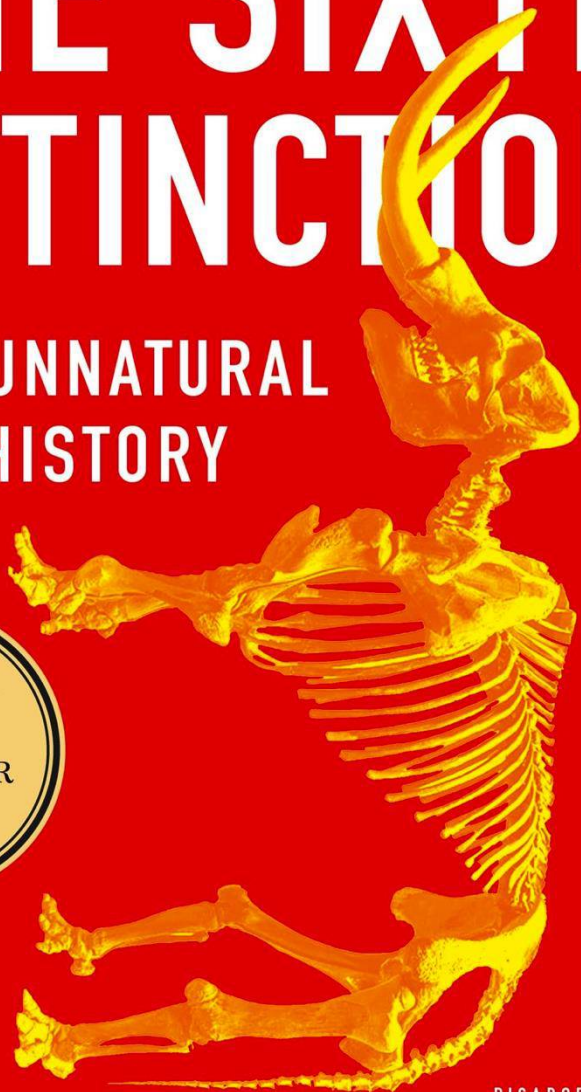
Sixth  
Mass  
Extinction  
Starting

NEW YORK TIMES BESTSELLER

# THE SIXTH EXTINCTION

AN UNNATURAL  
HISTORY

WINNER  
of the  
PULITZER  
PRIZE



PICADOR

ELIZABETH KOLBERT

Author of *FIELD NOTES  
FROM A CATASTROPHE*

# dodging extinction

"When a paleontologist warns that something very unusual in earth's history is taking place right now, everyone ought to pay attention."

Elizabeth Kolbert,  
author of *The Sixth Extinction*

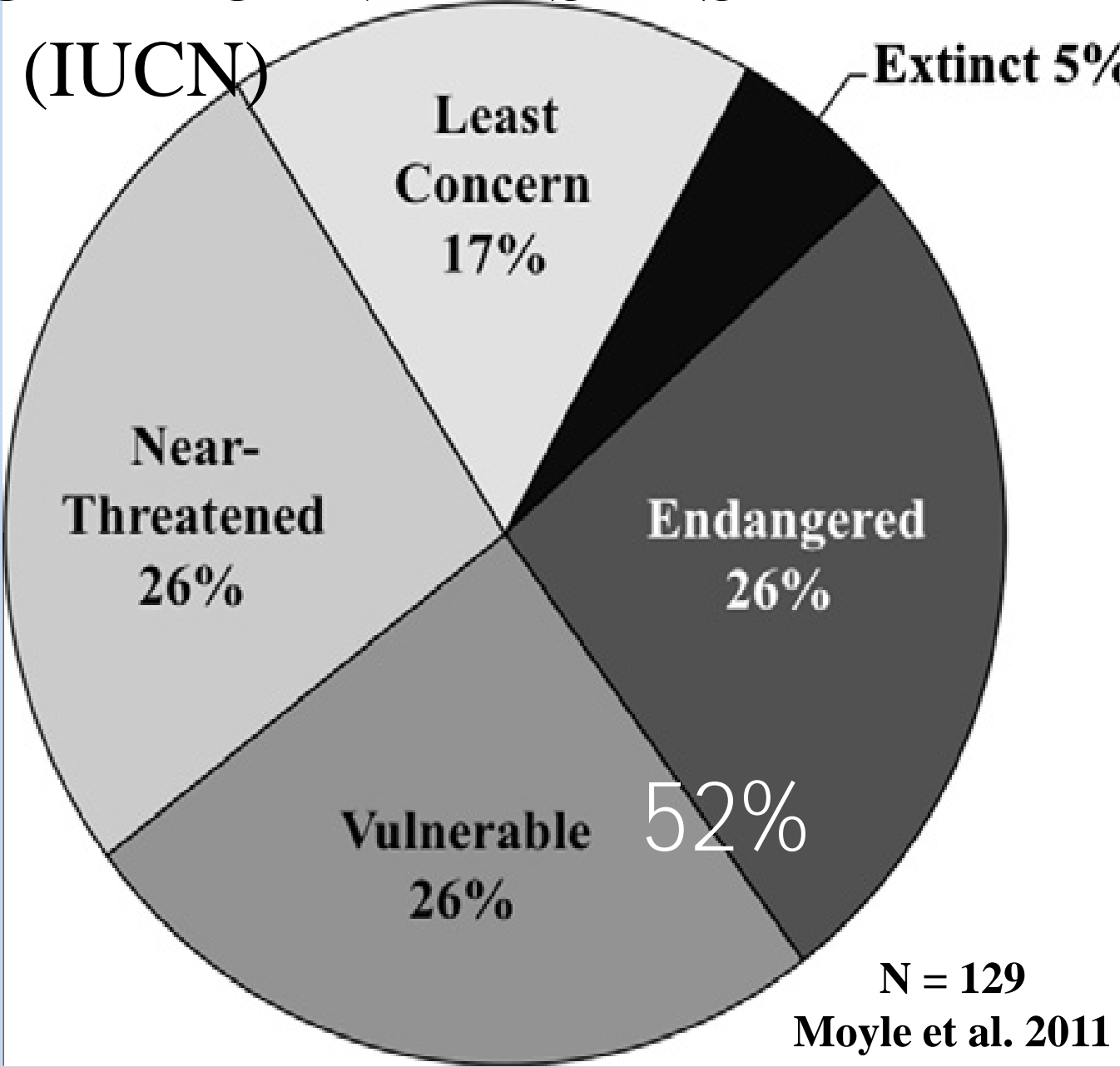


power,  
food,  
money,  
and the future of life on earth

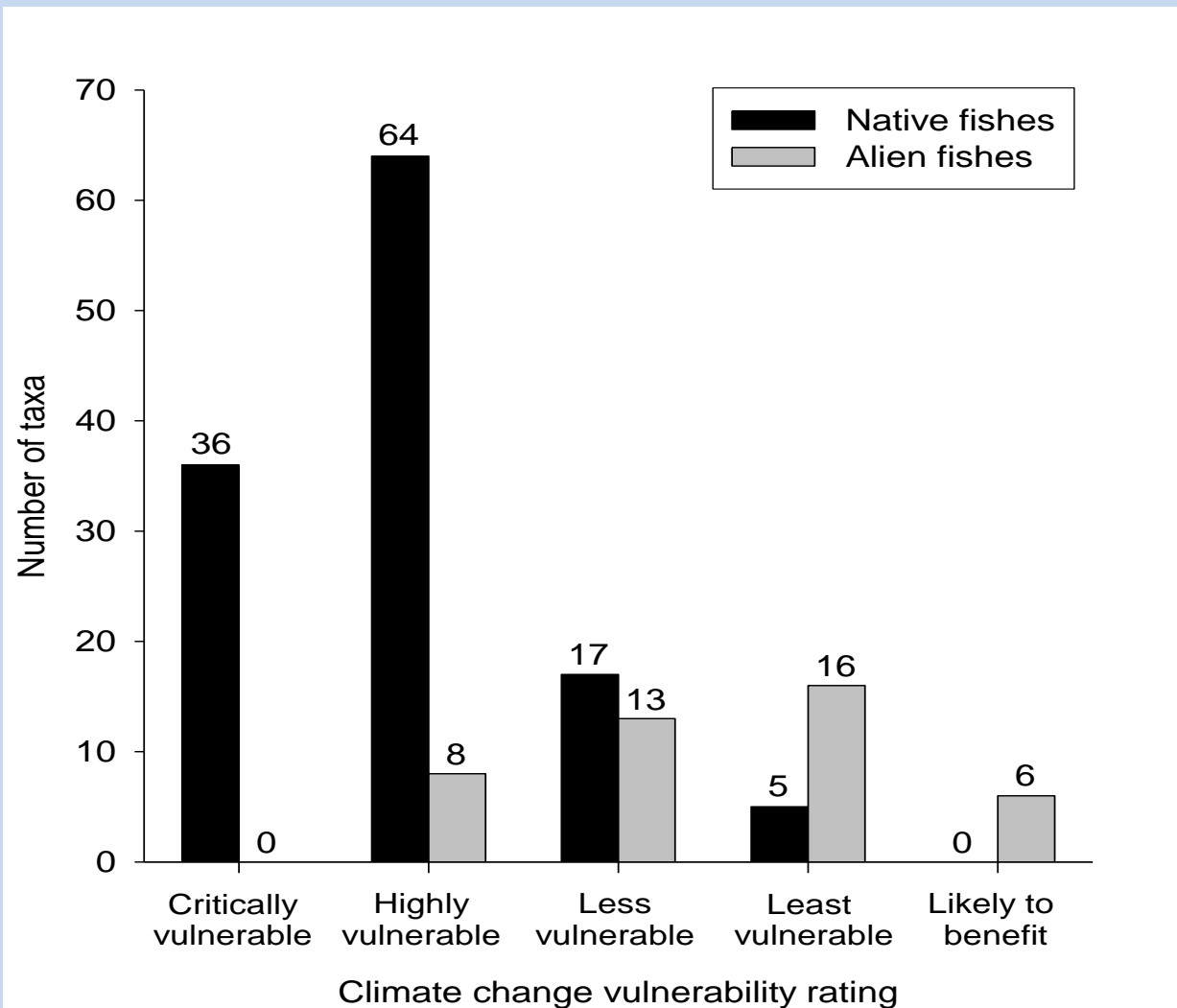
ANTHONY D. BARNOSKY

# STATUS OF CALIFORNIA FISHES

**57%**  
extinct or  
in danger of  
extinction'  
w/o climate  
change



# Climate change vulnerability



critical or high  
vulnerability to  
extinction

Natives =

82%

vs.

Aliens = 19%

Taxa about = to species

# Extinction

- What is it?
- How is it declared?
- How should it be determined?
  - A proposal.



# What is extinction?

1. Conservation reliance
2. Functional extinction
3. Regional extinction
4. Extinct in native range
5. Extinct in the wild
6. Visual extinction
7. Complete (global) extinction
8. Resurrection (Jurassic Park)



Tecopa Springs pupfish

# Conservation reliant species

- Species that depend on continuous human intervention to sustain populations.
- Extinct without human help.



Winter run chinook salmon



# Functionally extinct species

- Once abundant species that are still present in native range but so rare they do not contribute to ecosystem processes *e.g.* not important in food webs.



# Regional Extinction

- Species that are still extant, but extinct (extirpated) from a geographically defined part of native



2<sup>ND</sup> TO LAST

BULL TROUT

CAUGHT in CA

SEPT. 1975

# Extinct in Wild

- A species that is entirely maintained by captive populations with no presence in natural environment. Extreme conservation reliance.

Mohave tui  
chub



# Extinct in native range

- Still extant as wild populations but absent from native range; all populations the result of introductions outside native range.



Sacramento perch

# Visually extinct species

- Species so rare no one sees them any more; unverified extinction.



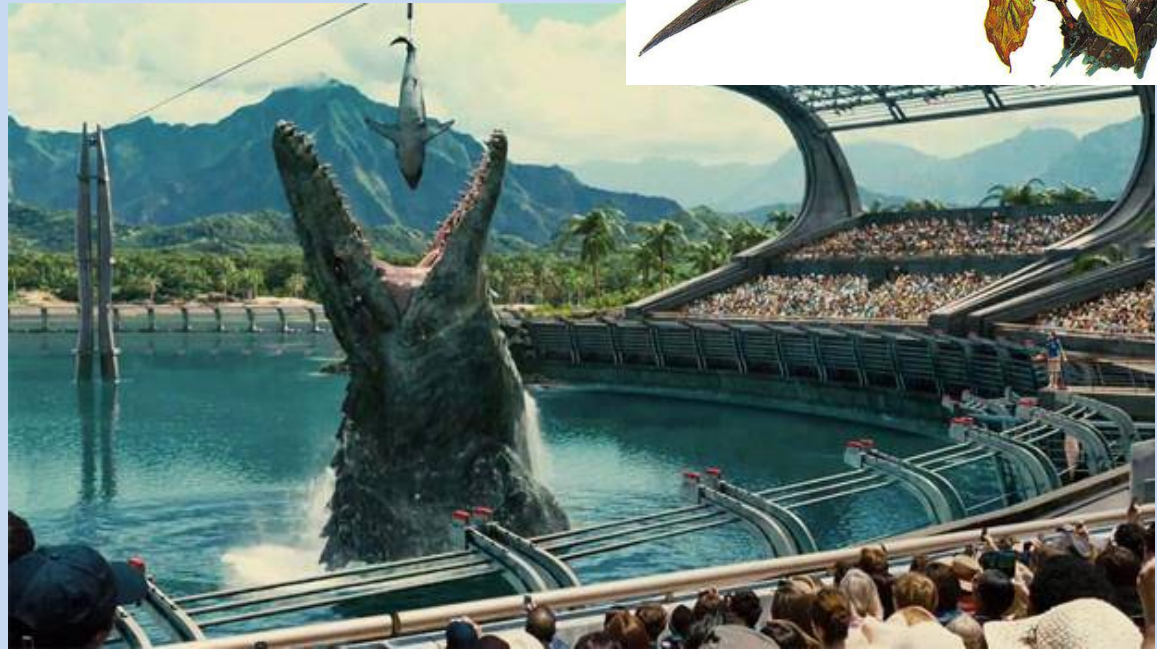
IUCN (1994): a species is extinct “when there is no reasonable doubt the last individual has died.”

# Global (absolute) extinction

- A species which is no longer present in wild or in captive populations on planet Earth.

# Resurrection extinction reversal?

- Jurassic Park
- Passenger pigeon
- DNA

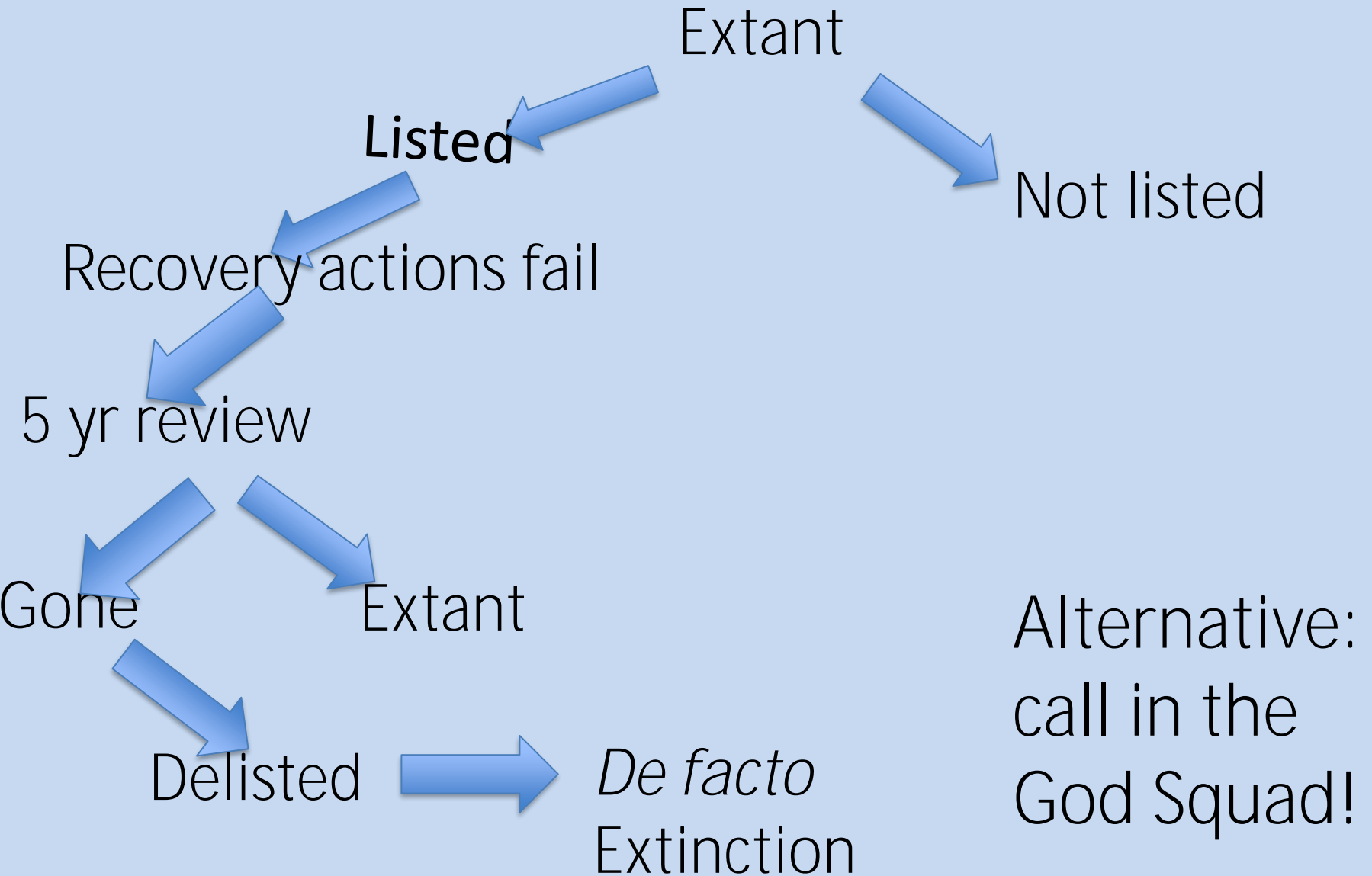


# How could global extinction be declared?

1. Species listed under state and federal ESAs
2. Recovery actions fail
3. Innovative, desperation measures fail
4. 5 year review: determined not to be extant
5. Delisted (de facto extinction)
6. Feds: Director of USFWS approves decision
7. State: CDFW petitions Fish and Game Commission

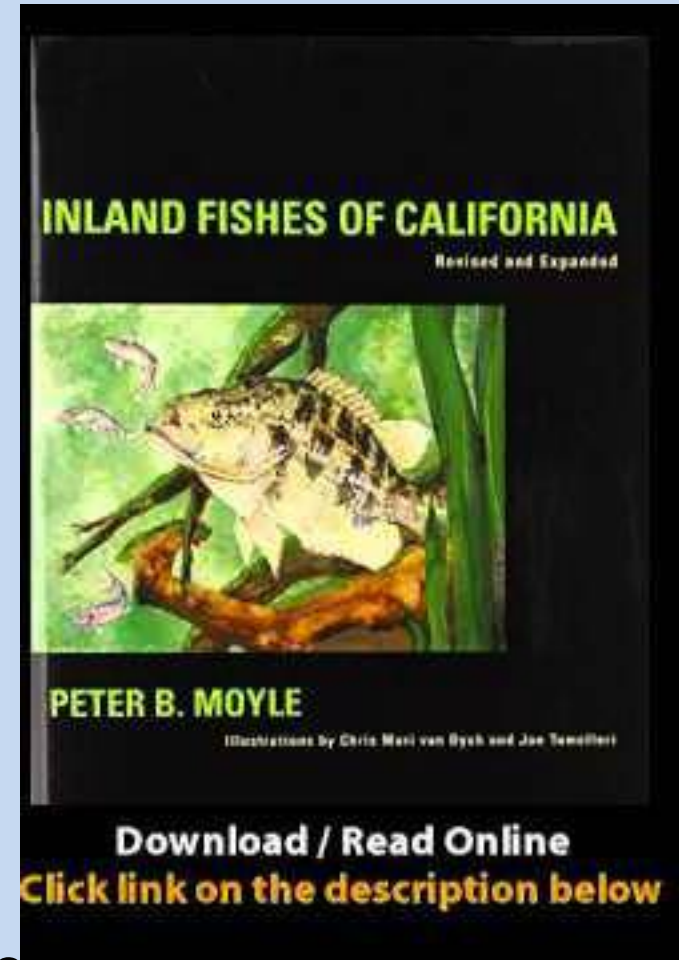


# How extinction is declared



# How should extinction be determined?

- No widely accepted criteria
- Consensus of experts
- Reported in literature
  - Inland Fishes of California
- IUCN: 50 years of no detection



# How should extinction be determined?

## A proposal for fish in CA

1. Recovery measures fail
2. Determine absence from routine surveys
3. Do intensive surveys in likely & unlikely places
4. Go back to routine surveys for x generations
5. Determine likelihood it is still extant
6. Present findings to Multiagency Committee
7. Committee makes recommendation to director of CDFG or Fish and Game Commission
8. Governor declares extinction

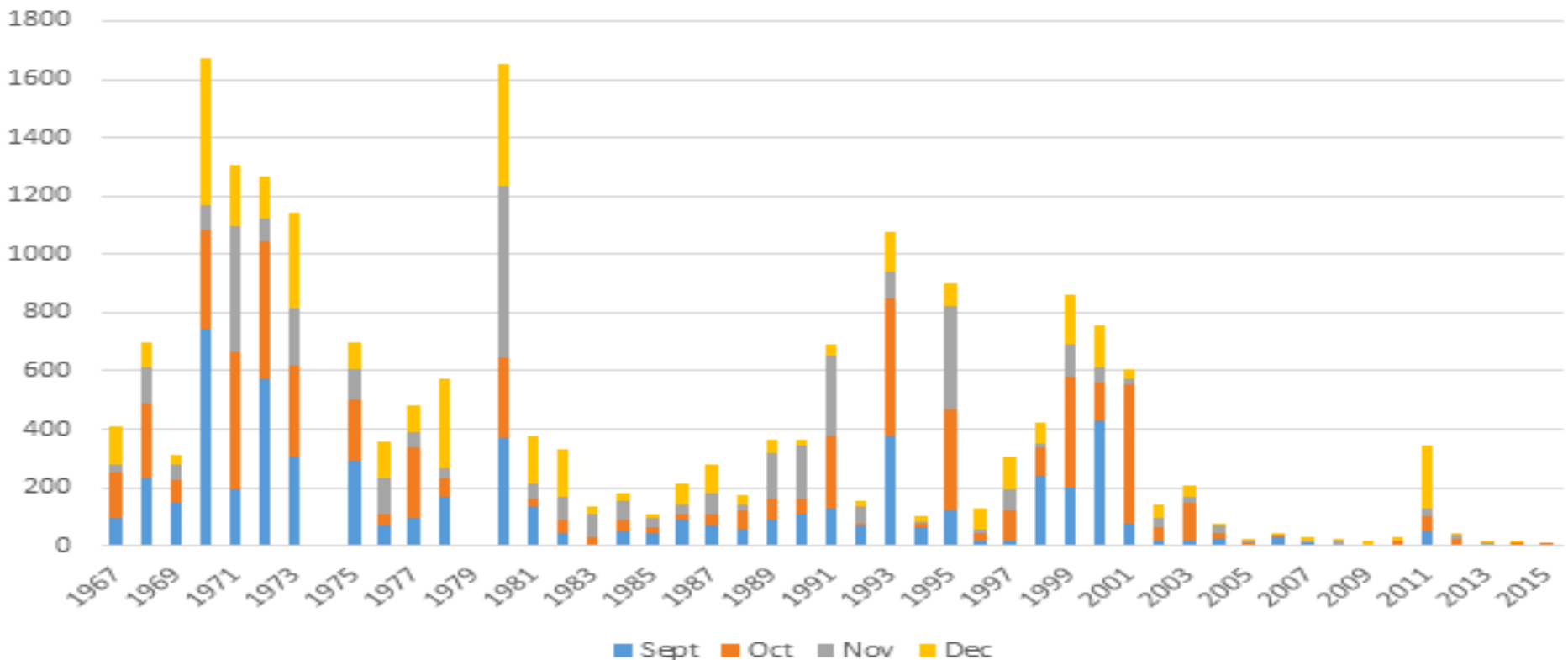
# 1. Recovery measures fail ordinary and extraordinary



# 2. Determine absence from routine surveys



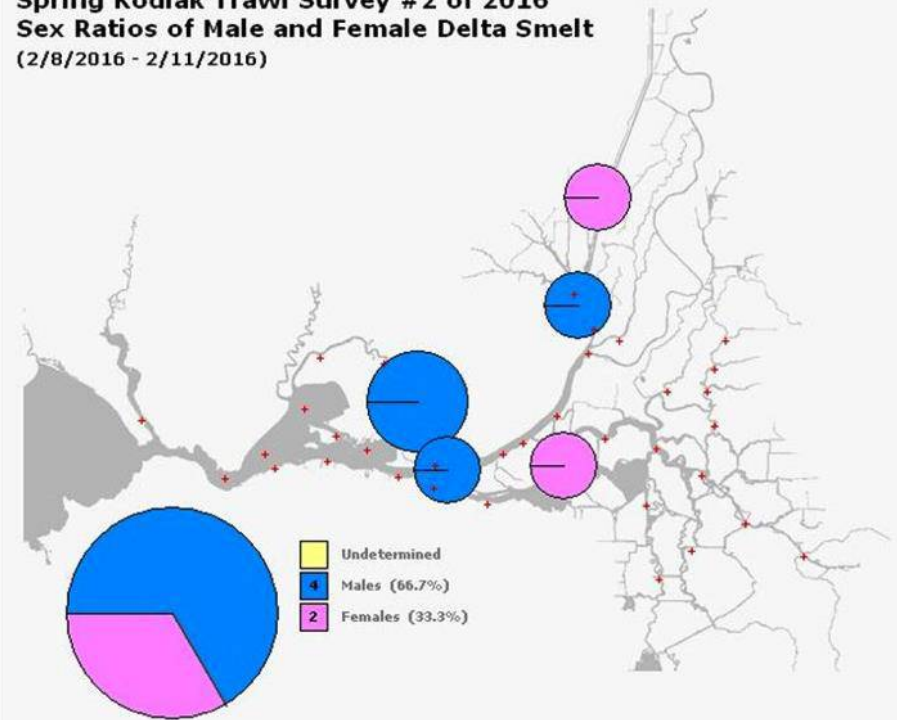
Delta Smelt Midwater T



# 3. Conduct intensive surveys in likely and unlikely places



**Spring Kodiak Trawl Survey #2 of 2016**  
**Sex Ratios of Male and Female Delta Smelt**  
(2/8/2016 - 2/11/2016)



## 4. Go back to routine surveys for x generations

- Generation time 1-5 years = 10 generations
- Generation time 5+ years = 5 generations
- Isolated or small habitats = 1 generation/year



Delta smelt = 10 or 20 years

# Final Steps



5. Determine likelihood species is still extant
  1. Expert opinion
  2. Data
  3. Modeling
6. Present findings to Multiagency Committee
7. Committee makes recommendation to Director of CDFW or FG Commission
8. Governor declares extinction



# Extinction: summary

- Likely to be common in future
- Comes in many flavors
- Legal means exist to delist extinct species
- Formal process needed for determination.

?

