FROGCALL

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NEWSLETTER No. 161 JUNE 2019

You are invited to our FATS meeting. It's free. Everyone is welcome.

Photo by Aaron Payne - *Litoria littlejohni*

Arrive from 6.30 pm for a 7pm start.

Friday 7 June 2019

FATS meet at the Education Centre, Bicentennial Pk, Sydney Olympic Park

Easy walk from Concord West railway station and straight down Victoria Ave. Take a torch in from June.

By car: Enter from Australia Ave at the Bicentennial Park main entrance, turn off to the right and drive through the park. It's a one way road.

Or enter from Bennelong Rd / Parkway. It is a short stretch of two way road.

Park in P10f car park, the last car park before the Bennelong Rd. exit gate.

FATS meeting, Friday 7th June 2019

6.30 pm Lost Green Tree Frogs *Litoria caerulea* frogs and "friends" seeking forever homes: Priority to new pet frog owners. Please bring your membership card and cash $50 donation. Sorry, we don't have EFTPOS. Your NSW NPWS amphibian licence must be sighted on the night. Adopted frogs can never be released.

7.00 pm Welcome and announcements

7.30 pm Our main speaker is Glenn Shea continuing his talk on "The early European history of discovery and study of Sydney's frogs Part 2 – the rise of local naturalists".

9.00 pm Show us your frog images. Tell us about your frogging trips or experiences. Guessing competition, frog adoptions continue, supper, relax and chat with frog friends and experts.

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FATS MEETING 5 APRIL 2019

Punia Jeffery opened our meeting and welcomed everyone. She announced that Rick Shine from the Royal Zoological Society (RZS) talked about Cane Toads at the Botany View Hotel, Newtown in April 2019. Punia reminded New South Wales visitors and members that amphibian annual returns are due to by end April to (NSW OEH) Office of Environment and Heritage (or their replacement department). Anyone with a frog licence should complete the return as soon as possible either electronically or by post using supplied OEH books. FATS were at the Royal Sydney Easter Show in 2019 on the last Monday and Tuesday. In January 2020 the 9th International Conference on Herpetology will be held in Duneden New Zealand.

Our main speaker was systematics herpetologist, Glenn Shea from Sydney University, talking about the early European history, discovery and study of Sydney frogs. Glenn works on the recognition, description and naming of new species. Glenn is interested in the relationship between describing species and the often much earlier collection or source of the animals. Often the person naming the species was in Europe and had never seen the species alive. Specimens had sometimes lost their colour pigmentation or the locality was too broad eg "New Holland".

Kurnell illustration from John Whites Journal of the Voyage to New South Wales, in the Endeavour.

By going back in time and looking at who these collectors were and where they were at the time helps herpetologists work out more information about Australian herpetofauna. Where the original description is not all that precise eg "little brown frog" and the location is somewhere in Australia, knowing more about the collector can help identify the frog.

Looking at these collectors, some were real characters, people who were otherwise unknown, Up until the 1860's frog descriptions were done in Europe. Collectors prior to that tended to concentrate on the big colourful frogs, which were more noticeable. Little frogs got short shrift until later on.

The first Australian frog to reach UK collections was associated with John White, the original surgeon to the first fleet. In 1790 George Shaw and John Hunter in the British Museum received his journal which included one "Blue Frog" (later named Green Tree Frog, *Litoria caerulea*) description and specimen. Could the small frogs in the sketch (bottom left of page) be Crinia?

John White 1756 – 1832 Surgeon to First Fleet

The second Australian frog described from a painting by George Shaw was originally called *Rana australiaca* (a helioporus). Shaw is infamously known for his decision to burn collections at the British Museum, (having thought he could replace them with new specimens) including dodos. Many were never been replaced.

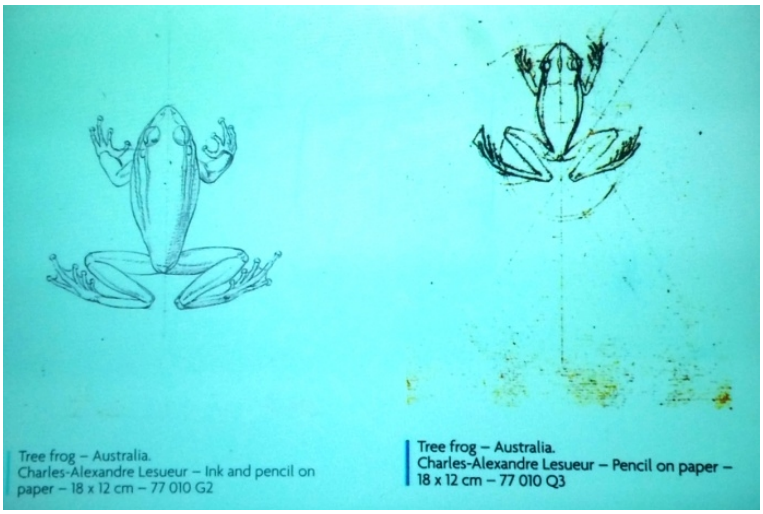
"Caccia del vitelmarino e suo grande Nido all'Isola Hartik." Hunting by the sea from the grand voyage of Dirk Hartik's island. Rare lithograph from an unidentified Italian publication. Copied from Nicolas Petit plates in "Voyage de Decouvertes aux Terres Australes" by Francois Peron.

Glenn Shea talked about the French interest in mapping and potentially settling in Australia from the 1800's. Th first expedition being captained by Nicholas Baudin.

Many of the scientists jumped ship or died along the way.

François Péron 1775 – 1810 (11?)

By the time the ships reached Sydney in 1802 the only scientist left was François Péron and gunners mate and drawing enthusiast Charles Alexandre Lesueur. (1778-1846),



Charles Alexandre Lesueur 1818 painted by Charles Peale

Péron was largely responsible for gathering some 100,000 zoological specimens - the most comprehensive Australian natural history collection to date. They had two trips to Parramatta identifying several frogs including Perons Tree Frog (later called *Litoria peroni*) but he never formally describing or publishing them.

André Marie Constant Duméril 1774 **- 1860**

In the late 1830s and early 40s general amphibian publications such as *Herpetology Generale*, started to appear, eg Crinia. A second French expedition came to Sydney in 1824. Some of the collections were lost in a ship wreck.

Solicitor and collector Joseph Wright sent back to the UK a red crowned toadlet around 1835.

By the mid 1800's a further collection of Australian frogs was made by Jules Verreaux. The Americans in the 1840's sent an expedition seeking Antartica. It stopped off at Sydney. Pickering collected a few frogs there. By 1857 little brown frogs like *Crinia signifera* were finally described, even though they had been collected for the last 60 years.

Painting by Charles-Alexandre Lesueur of one of the two specimens of *Pseudophryne bibronii* collected at Parramatta by François Péron. Image (extract from vellum 77003, Lesueur collection) courtesy of Gabrielle Baglione (Museum d'Histoire Naturelle du Havre).

Glenn Shea will continue his talk on the early European history of Sydney frogs at our June 2019 meeting.

Punia Jeffery spoke about the most recent FATS field trip to Smiths Lake. Images from Punia, Arthur White, Josie Styles and Peter Spradbrow (to name just a few) were included in the presentation, eg a significant brachiopod fossil from the carboniferous period at Seal Rocks, found by Arthur White, part dingo visitor, plover, swans, small eyed snake, ribbon worms, koala tree scratchings, osprey, red backed toadlet, eels (one called "The Cracken" living very close to the field station), geckos and many, many more.

Seal Rocks and Smiths Lake are very rich for geology, fauna and flora. Group photo by Arthur White.

Clean boots means Clean conscience. Arthur White spoke about a significant paper on Chytrid Fungus (see pages 6 to 9). A recent publication about Chytrid which is short for Chytridiomycosis, (Bd) - a disease resulting in massive frog declines and extinctions across the world over the last 20 years, has been produced. Chytrid is credited with frog extinctions across the planet. The study suggests this epidemic is hitting some parts of the world worse than others. Australia had massive loss of frogs in the 1970's and 80's.

This nasty pathogen (Batrachochytrium) was around in 1902 and identified in a Japanese Giant Salamander. The next Bd infected amphibian was an African Clawed Frog *Xenopus laevis* collected in 1938. The pandemic wasn't to start till the 1970's. What was the kick start? It wasn't pollution, it's something else?

The micro organism was mapped in 56 out of 82 countries and in 42% of the 1240 frog species (36,000 individuals). Outcomes varied, with Asia having only 2.35% prevalence, suggesting the disease originated there.

The worst place for Chytrid infection is South America. Australia comes just after that. In Asia, there are the fewest numbers of frogs affected by Bd. Why? Perhaps the organism originated in Asia and the frogs have been able to adapt to the pathogen over a longer time. There is a decline of over 500 species of frogs in the last half century with 90 presumed extinctions.

Typically larger frogs, range restricted and from the wetter climates are most affected. 12% of species in decline are showing some sign of recovery across the world. Is it that the frogs are developing some immunity or is it that the pathogen is less virulent or is there a new factor? Nearly 40% of the amphibian species are heading to extinction. Life history of different amphibian species and temperatures may be a better clue than taxonomy.

There is the risk of further outbreaks with global travel. Therefore the importance of biosecurity to reduce future outbreaks. There is a persistence in reservoir host species that allow Bd to continue on as some frogs have resistance to the pathogen and are just carriers eg Crinia. Habitat loss and disturbance was another cause of amphibian declines. You have to assume any frog you come across, even in your own garden, could be affected by Bd. The Bd panzootic represents the greatest recorded loss of biodiversity attributable to a disease.

Chytrid spores can be transferred in damp soil, hair and clothing. Water, soil, frogs and tadpoles must not be moved between wetlands. Assume all frogs you encounter are affected. Boots, equipment, and other items in contact with water must be sterilized. Infected frogs in captivity can be treated. **Clean boots, car wheels, gloves, equipment = Clean conscience.**
Citation: Science paper free download. See FrogCall 161 pages 6 to 9. **Scheele, et al. 2019 Amphibian fungal panzootic causes catastrophic and ongoing loss of biodiversity. Science Vol. 363, Issue 6434, pp. 1459-1463**

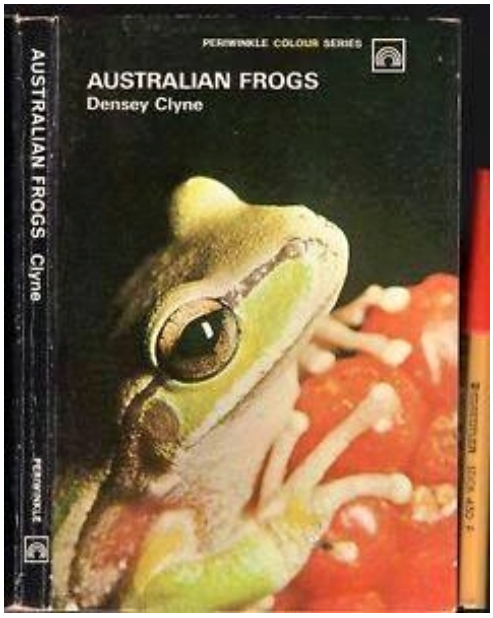
Arthur White talked about the Bell Frog tadpole release at Arncliffe. Channel 9 aired news about the Green and Golden Bell Frog *Litoria aurea* conservation project and Westconnex / M5 construction. The last 13 adults of the Botany Bay population are now in a fully enclosed site, protected from public access and construction. It will take five years to know if saving the population, is successful.

The two hectare foraging site is limited and needs expansion. Council has public land adjacent to the site. It is needed by the frogs, but a private developer wants to buy it. The F6 motorway may be another competitor for the critical expanded habitat.

Thank you to our fabulous speakers, Glenn Shea, Punia Jeffery and Arthur White. Easter raffle and supper was held at the end of the meeting. **MW**

VALE - AUTHOR AND NATURALIST DENSEY CLYNE 1922 - 2019

Densey Clyne was an Australian naturalist, photographer and writer, especially well known for her studies of spiders and insects. She wrote one of the first frog guides for south-eastern Australia.



Densey Clyne was a Fellow of the Royal Entomological Society of London. She is known for her contributions to arachnology and has had two species of spider named after her. Densey's scientific contributions include the first detailed description of the netmaking behaviour and sperm induction of the spider *Dinopis subrufa*, (*Australian Zoologist*, 1967) and countless awards.

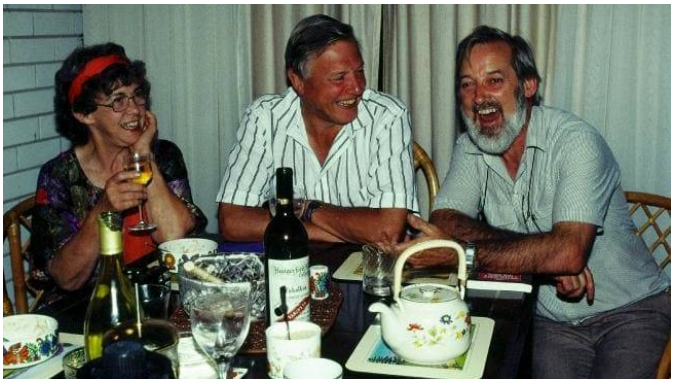
"Her frog reference book was preceded by Bert Main's Frogs of Southern Western Australia (1965), published by the Western Australian Naturalists Club, which was the first true regional field guide for Australian frogs, and even earlier, by Hal Cogger's Frogs of New South Wales (1960), although with a quarto size and paper covers, this was not really a field guide. But still Densey's book is a landmark publication for its time." **Glenn Shea**

Vale: Densey Clyne, in her beautiful gardens at Redbank.

Wauchope resident, long-time friend of Sir David Attenborough, author and naturalist Densey Clyne has died, age 96. Her environmental work with cinematographer Jim Frazier and lifelong study of insects, plants and the delicate relationship between all living things was ground-breaking. Her lifetime was dedicated to exploring, understanding and sharing knowledge about the natural world.

Densey has spent the past 18 years of her life developing her beautiful gardens at Redbank which includes a frog pond fashioned from a former swimming pool. She always wanted a cottage garden, Densey said, to honour her English heritage. And it was a garden that brought joy to all who visited when she opened the front gates to the public. She has been a writer, photographer, speaker, TV presenter, producer, scripted documentaries and worked with the legendary Sir David Attenborough.

To show small subjects in close-up, Densey taught herself macro photography. Over the years, her innovative photographs were becoming well-known, but she lived a private life, gardening, writing, observing nature, never envisaging a career in wildlife.



Densey Clyne, Jim Frazier and Sir David Attenborough. Picture: Jim Frazier.

For everyone who knew Densey, or had the privilege of enjoying her beautiful garden, may the magic of the natural world live on and inspire generations to come. **https://www.portnews.com.au/story/6135954/densey-clyne-leaves-an-environmental-legacy-we-all-must-protect/?fbclid=IwAR2N6qDL3oTBdgInVFcBZv6DooPifU82Lfd5BMYfXZarhWswxak8HPN2pHE by Tracey Fairhurst**

MASS AMPHIBIAN EXTINCTIONS GLOBALLY CAUSED BY FUNGAL DISEASE

An international study has found a fungal disease has caused dramatic population declines in more than 500 amphibian species, including 90 extinctions, over the past 50 years. The disease, which eats away at the skin of amphibians, has completely wiped out some species, while causing more sporadic deaths among other species. Amphibians, which live part of their life in water and the other part on land, mainly consist of frogs, toads and salamanders.

The deadly disease, chytridiomycosis, is present in more than 60 countries -- the worst affected parts of the world are Australia, Central America and South America. Lead researcher Dr Ben Scheele said the team found that chytridiomycosis is responsible for the greatest loss of biodiversity due to a disease. "The disease is caused by chytrid fungus, which likely originated in Asia where local amphibians appear to have resistance to the disease," said Dr Scheele from the Fenner School of Environment and Society at ANU.

He said the unprecedented number of declines places chytrid fungus among the most damaging of invasive species worldwide -- similar to rats and cats in terms of the number of species each of them endangers. "Highly virulent wildlife diseases, including chytridiomycosis, are contributing to the Earth's sixth mass extinction," Dr Scheele said. "The disease we studied has caused mass amphibian extinctions worldwide. We've lost some really amazing species."

Dr Scheele said more than 40 frog species in Australia had declined due to the fungal disease during the past 30 years, including seven species that had become extinct. "Globalisation and wildlife trade are the main causes of this global pandemic and are enabling the spread of disease to continue," he said. "Humans are moving plants and animals around the world at an increasingly rapid rate, introducing pathogens into new areas."

Dr Scheele said improved biosecurity and wildlife trade regulation were urgently needed to prevent any more extinctions around the world. "We've got to do everything possible to stop future pandemics, by having better control over wildlife trade around the world."

Dr Scheele said the team's work identified that many species were still at high risk of extinction over the next 10-20 years from chytridiomycosis due to ongoing declines.

"Knowing what species are at risk can help target future research to develop conservation actions to prevent extinctions."

Dr Scheele said conservation programs in Australia had prevented the extinction of frog species and developed new reintroduction techniques to save some amphibian species. "It's really hard to remove chytrid fungus from an ecosystem -- if it is in an ecosystem, it's pretty much there to stay unfortunately. This is partly because some species aren't killed by the disease," he said. "On the one hand, it's lucky that some species are resistant to chytrid fungus; but on the other hand, it means that these species carry the fungus and act as a reservoir for it so there's a constant source of the fungus in the environment.

Co-researcher Dr Claire Foster, who is also from the Fenner School of Environment and Society, said the ANU-led study involved close collaboration with Professor Frank Pasmans and Dr Stefano Canessa at the University of Ghent, Belgium, alongside 38 different amphibian and wildlife disease experts from around the world. "These collaborators enabled us to get first-hand insight into what has been happening on the ground in those countries," she said.

The study is published in *Science* and was supported by the Threatened Species Recovery Hub of the Australian Government's National Environmental Science Program. **28 March 2019 Australian National University**
Journal Reference: Ben C. Scheele et al. Amphibian fungal panzootic causes catastrophic and ongoing loss of biodiversity. *Science*, 2019
DOI: 10.1126/science.aav0379
https://www.sciencedaily.com/releases/2019/03/190328150806.htm

AMPHIBIAN FUNGAL PANZOOTIC CAUSES CATASTROPHIC AND ONGOING LOSS OF BIODIVERSITY

1. Ben C. Scheele, Frank Pasmans, Lee F. Skerratt, Lee Berger, An Martel, Wouter Beukema, Aldemar A. Acevedo, Patricia A. Burrowes, Tamilie Carvalho, Alessandro Catenazzi, Ignacio De la Riva, Matthew C. Fisher, Sandra V. Flechas, Claire N. Foster, Patricia Frías-Álvarez, Trenton W. J. Garner, Brian Gratwicke, Juan M. Guayasamin, Mareike Hirschfeld, Jonathan E. Kolby, Tiffany A. Kosch, Enrique La Marca, David B. Lindenmayer, Karen R. Lips, Ana V. Longo, Raúl Maneyro, Cait A. McDonald, Joseph Mendelson III, Pablo Palacios-Rodriguez, Gabriela Parra-Olea, Corinne L. Richards-Zawacki, Mark-Oliver Rödel, Sean M. Rovito, Claudio Soto-Azat, Luís Felipe Toledo, Jamie Voyles, Ché Weldon, Steven M. Whitfield, Mark Wilkinson, Kelly R. Zamudio, Stefano Canessa See all authors and affiliations
Science **29 Mar 2019: Vol. 363, Issue 6434, pp. 1459-1463**
DOI: 10.1126/science.aav0379

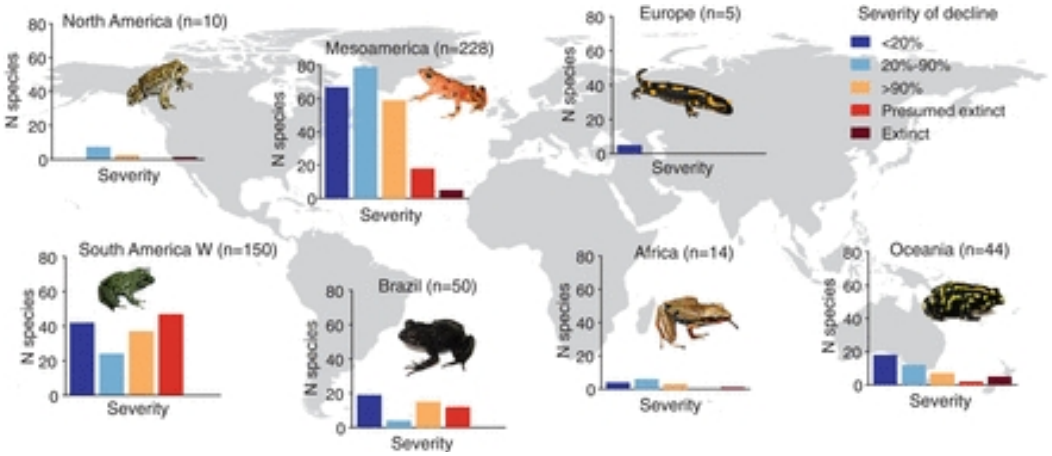
The demise of amphibians?

Rapid spread of disease is a hazard in our interconnected world. The chytrid fungus *Batrachochytrium dendrobatidis* was identified in amphibian populations about 20 years ago and has caused death and species extinction at a global scale. Scheele *et al.* found that the fungus has caused declines in amphibian populations

everywhere except at its origin in Asia (see the Perspective by Greenberg and Palen). A majority of species and populations are still experiencing decline, but there is evidence of limited recovery in some species. The analysis also suggests some conditions that predict resilience.

***Science*, this issue p. 1459; see also p. 1386**

Abstract Anthropogenic trade and development have broken down dispersal barriers, facilitating the spread of diseases that threaten Earth's biodiversity. We present a global, quantitative assessment of the amphibian chytridiomycosis panzootic, one of the most impactful examples of disease spread, and demonstrate its role in the decline of at least 501 amphibian species over the past half-century, including 90 presumed extinctions. The effects of chytridiomycosis have been greatest in large-bodied, range-restricted anurans in wet climates in the Americas and Australia. Declines peaked in the 1980s, and only 12% of declined species show signs of recovery, whereas 39% are experiencing ongoing decline. There is risk of further chytridiomycosis outbreaks in new areas. The chytridiomycosis panzootic represents the greatest recorded loss of biodiversity attributable to a disease.



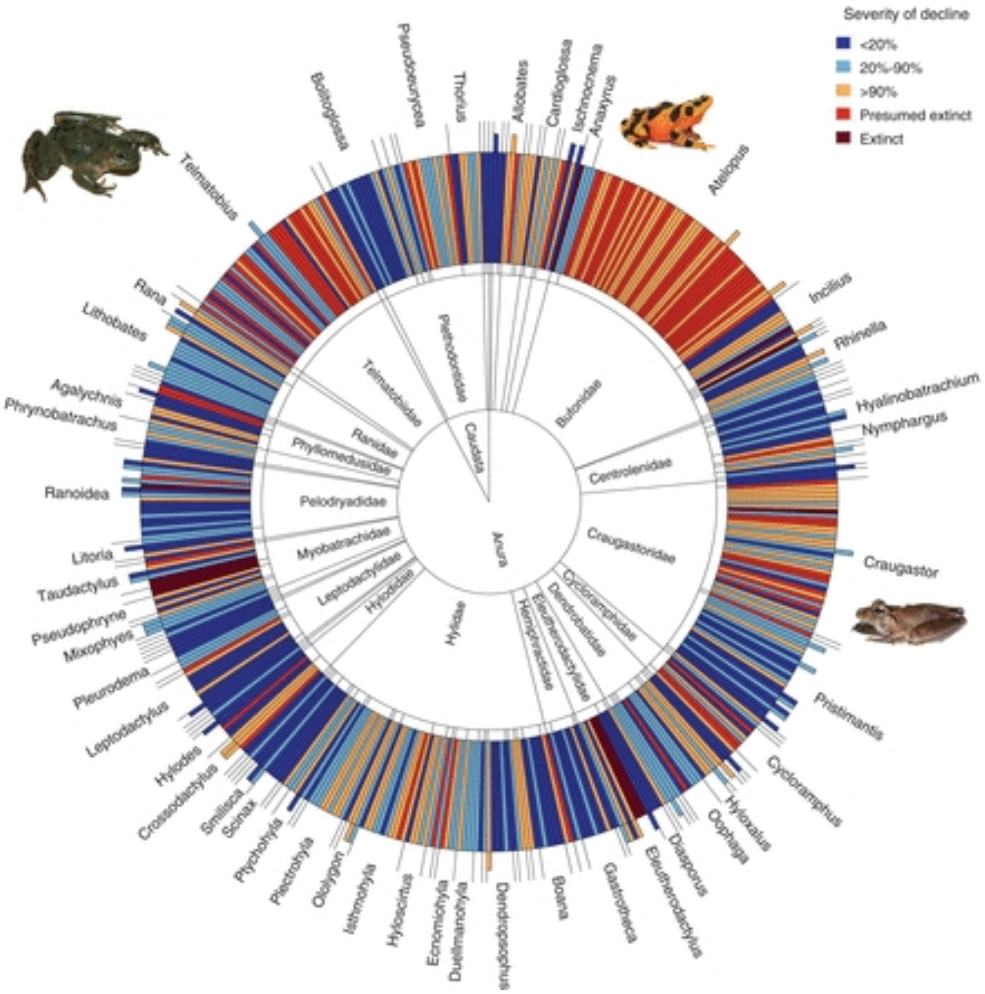
F1 Global distribution of chytridiomycosis-associated amphibian species declines.

Bar plots indicate the number (N) of declined species, grouped by continental area and classified by decline severity. Brazilian species are plotted separately from all other South American species (South America W); Mesoamerica includes Central America, Mexico, and the Caribbean Islands; and Oceania includes Australia and New Zealand. No declines have been reported in Asia. *n*, total number of declines by region. [Photo credits (clockwise from top left): *Anaxyrus boreas*, C. Brown, U.S. Geological Survey; *Atelopus varius*, B.G.; *Salamandra salamandra*, D. Descouens, Wikimedia Commons; *Telmatobius sanborni*, I.D.l.R; *Cycloramphus boraceiensis*, L.F.T.; *Cardioglossa melanogaster*, M.H.; and *Pseudophryne corroboree*, C. Doughty]

Highly virulent wildlife diseases are contributing to Earth's sixth mass extinction (***1***). One of these is chytridiomycosis, which has caused mass amphibian die-offs worldwide (*2*, *3*). Chytridiomycosis is caused by two fungal species, *Batrachochytrium dendrobatidis* [discovered in 1998, (*4*)] and *B. Salamandrivorans* [discovered in 2013, (*5*)]. Both *Batrachochytrium* species likely originated in Asia, and their recent spread has been facilitated by humans (*5*, *6*). Twenty years after the discovery of chytridiomycosis, substantial research has yielded insights about its epidemiology (*2*, *3*, *7*, *8*), yet major knowledge gaps remain. First, the global extent of species declines associated with chytridiomycosis is unknown [see (*2, 9*) for initial assessments]. Second, although some regional declines are well studied, global spatial and temporal patterns of chytridiomycosis impacts remain poorly quantified. Third, ecological and life history traits have been examined only for a portion of declined species (*10*, *11*). Finally, after initial declines, it is unknown what proportion of declined species exhibit recovery, stabilize at lower abundance, or continue to decline. Here we present a global epidemiological analysis of the spatial and temporal extent of amphibian biodiversity loss caused by chytridiomycosis.

We conducted a comprehensive examination of evidence from multiple sources, including the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (*12*), peer-reviewed literature, and consultation with amphibian experts worldwide (data S1). We classified declined species into five decline-severity categories corresponding to reductions in abundance. Species declines were attributed to chytridiomycosis on the basis of diagnosis of infection causing mortalities in the wild or, if this was unavailable, evidence consistent with key epidemiological characteristics of this disease. Most evidence is retrospective because many species declined before the discovery of chytridiomycosis (data S1).

We conservatively report that chytridiomycosis has contributed to the decline of at least 501 amphibian species (6.5% of described amphibian species; F1 and 2). This represents the greatest documented loss of biodiversity attributable to a pathogen and places *B. dendrobatidis*among the most destructive invasive species, comparable to rodents (threatening 420 species) and cats (*Felis catus*) (threatening 430 species) (*13*). Losses associated with chytridiomycosis are orders of magnitude greater than for other high-profile wildlife pathogens, such as white-nose syndrome (*Pseudogymnoascus destructans*) in bats (six species) (*14*) or West Nile virus (*Flavivirus* sp.) in birds (23 species) (*15*). Of the 501 declined amphibian species, 90 (18%) are confirmed or presumed extinct in the wild, with a further 124 (25%) experiencing a >90% reduction in abundance (F1 and 2). The declines of all species except one (*Salamandra salamandra* affected by *B. salamandrivorans*) were attributed to *B. dendrobatidis.*



F2 Taxonomic distribution of chytrid associated amphibian declines.

Each bar represents one species, and color denotes the severity of its decline. Concentric circles indicate, from inner to outer, order (Caudata or Anura), family, and genus. Full names are given only for families and genera that include >5 and >2 species, respectively; details for all taxa are in table S4. Within each taxonomic level, sublevels are ordered alphabetically. Protruding bars indicate species for which there is evidence of recovery. [Photo credits (left to right): *Telmatobius bolivianus*, I.D.l.R.; *Atelopus zeteki*, B.G.; and *Craugastor crassidigitus*, B.G.]

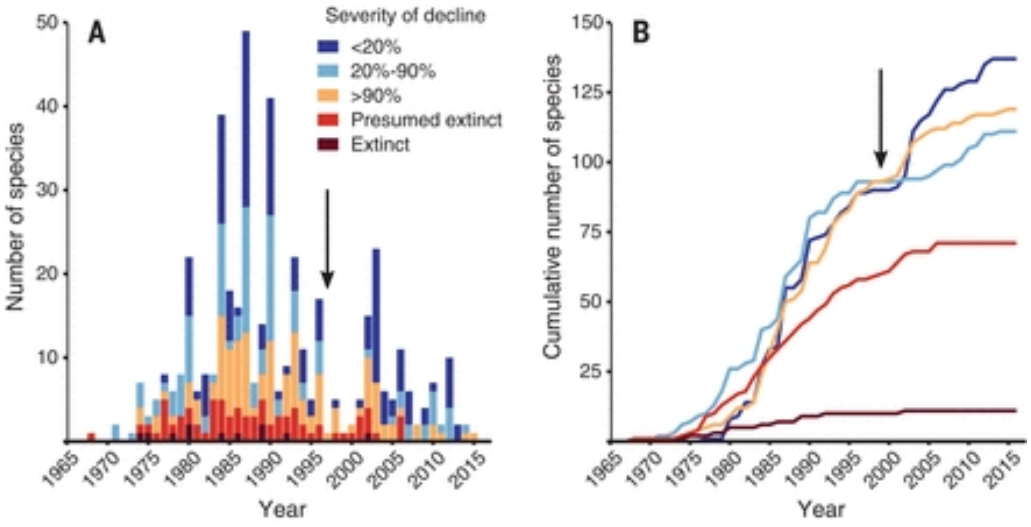
Declines were proportional to taxonomic abundance, with anurans having 93% of severe declines (they comprise 89% of all amphibian species). Within anurans, there has been marked taxonomic clustering of declines, with 45% of severe declines and extinctions occurring in the Neotropical genera *Atelopus*, *Craugastor*, and *Telmatobius* (F2) (*16*). Chytridiomycosis is lethal to caecilians (*17*), but there have been no caecilian declines due to the disease, although data are limited. The capacity for *B. dendrobatidis* to cause major declines is attributable to its maintenance of high pathogenicity (*2*, *18*), broad host range (*8*), high transmission rate within and among host species (*2*, *7*), and persistence in reservoir host species and the environment (*19*). For many species, chytridiomycosis is the principal driver of decline, exemplified by precipitous mass mortalities in undisturbed environments (*2*). In other species, chytridiomycosis acts in concert with habitat loss, altered climatic conditions, and invasive species to exacerbate species declines (*20*).

Most amphibian declines have occurred in the tropics of Australia, Mesoamerica, and South America (F1), supporting the hypothesis that *B. dendrobatidis* spread from Asia into the New World (*6*). Asia, Africa, Europe, and North America have had notably low numbers of declines attributable to chytridiomycosis, despite widespread occurrence of *B. dendrobatidis* (*8*). Relative lack of documented declines could reflect less knowledge of amphibian populations in Asia and Africa (*3*, *21*), early introduction and potential coevolution of amphibians and *B. dendrobatidis* in parts of Africa and the Americas [e.g., (*22*)], the comparatively recent emergence of *B. dendrobatidis* in Western and Northeast Africa (*6*), or unsuitable conditions for chytridiomycosis. It remains unknown whether chytridiomycosis contributed to widespread amphibian declines reported in North America and Europe in the 1950s to 1960s (*3*, *21*, *22*) or current enigmatic salamander declines in eastern North America. Although the number of new declines has now eased (F3), additional declines could occur if *B. dendrobatidis* or *B. salamandrivorans* are introduced into new areas, highly virulent lineages are introduced into areas that currently have less-virulent lineages (*6*), and/or environmental changes alter previously stable pathogen-host dynamics (*3*).

(A**)** Declines by year. Bars indicate the number of declines in a given year, stacked by decline severity. For species for which the exact year of decline is uncertain, the figure shows the middle year of the interval of uncertainty, as stated by experts or inferred from available data**. (**B**)** Cumulative declines. Curves indicate the cumulative number of declines in each decline-severity category over time. In (A) and (B), the arrows mark the discovery of chytridiomycosis in 1998.

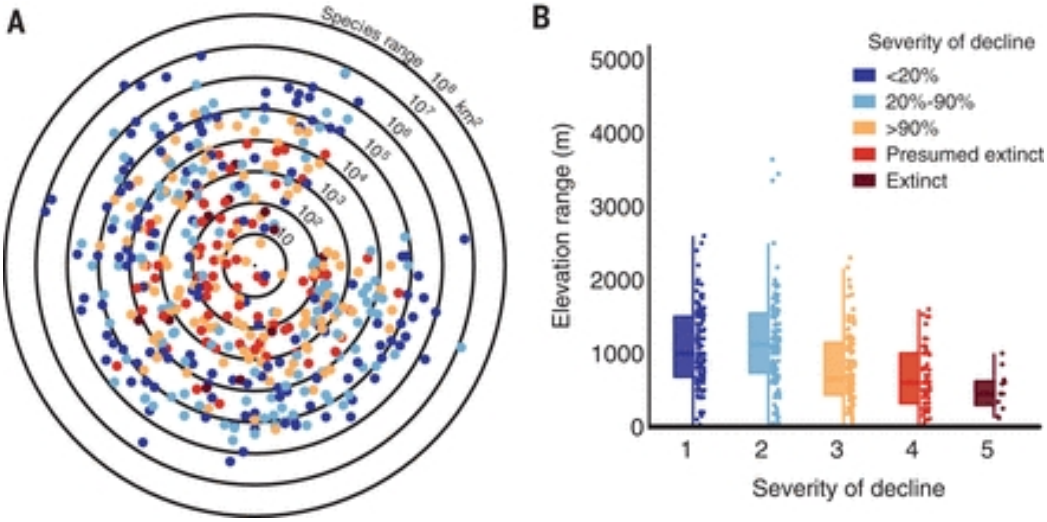
Chytridiomycosis-associated declines peaked globally in the 1980s, between one and two decades before the discovery of the disease (Fig. 3 and table S1), and coincident with anecdotal recognition of amphibian declines in the 1990s (*23*). A second, smaller peak occurred in the early 2000s, associated with an increase in declines in western South America (Fig. 3 and fig. S1). Regionally, temporal patterns of decline are variable (fig. S1). For example, in some areas of South America and Australia, declines commenced in the late 1970s (*2*, *24*), whereas in other areas, declines started in the 2000s (*25*). *B. dendrobatidis* is associated with ongoing declines in 197 assessed species. Ongoing declines after a transition to enzootic disease dynamics (*19*) might be driven by a lack of effective host defences, maintenance of

high pathogenicity (*18*), and presence of *B. dendrobatidis* in amphibian and nonamphibian reservoirs (*7*, *19*).



F3 Timing of chytridiomycosis-associated amphibian declines.

We examined host life history traits and environmental conditions to understand why some species declined more severely than others, using multinomial logistic regression and accounting for the degree of evidence that chytridiomycosis was implicated in each species' decline (fig. S2 and table S2). Decline severity was greatest for larger-bodied species, those occurring in consistently wet regions, and those strongly associated with perennial aquatic habitats. These patterns are likely due to favourable environmental conditions for *B. dendrobatidis* in wet regions (*7*), because the fungus dies when desiccated, as well as the general pattern of increased time to maturity in large-bodied amphibians resulting in less reproductive potential to offset mortality due to chytridiomycosis (*26*). Declines were less severe for species with large geographic and elevational ranges (F4), potentially owing to the greater chance of their range encompassing environmental conditions unfavourable for *B. dendrobatidis* (***3***) and/or information bias, because population extinctions can be assessed with more certainty in restricted-range species. Our results are consistent with previous studies that show that the risk of chytridiomycosis is associated with host aquatic habitat use, large body size, and narrow elevational range (*10*, *11*).



F4 Severity of chytridiomycosis-associated amphibian declines in relation to the geographic and elevational ranges of species.

(**A**) Declines in relation to geographic range. Each dot indicates a species, located randomly along the perimeter of a circle with radius equal to the $\log_{10}$ of the species' geographic range in kilometres squared. **(B)** Declines in relation to elevational range. Horizontal bars, boxes, and vertical bars indicate, respectively, mean, first and second quartiles, and 95% quantiles of elevation ranges within each category of decline severity.

Encouragingly, of the 292 surviving species for which population trends are known, 60 (20%) have shown initial signs of recovery. However, recoveries generally represent small increases in abundance of individual populations, not complete recovery at the species level. Logistic regression showed the probability of recovery was lower for species that experienced more recent or more severe declines, for large-bodied or nocturnal species, and for species occurring at higher elevations (fig. S2 and table S3). When holding those predictors of recovery at their mean value, the chance of a species recovering from a severe (>90%) decline was less than 1 in 10. Low probability of recovery for high-elevation species might be related to suitable climatic conditions for fungal persistence as well as limited connectivity to source populations and/or longer host generation time (*26*). Some recoveries may be underpinned by selection for increased host resistance (*18*), whereas management of concurrent threats may have facilitated other recoveries (a promising avenue for conservation interventions) (*27*). Unfortunately, the remaining 232 species have shown no signs of recovery.

The unprecedented lethality of a single disease affecting an entire vertebrate class highlights the threat from the spread of pathogens in a globalized world. Global trade has recreated a functional Pangaea for infectious diseases in wildlife, with far-reaching impacts on biodiversity (this study), livestock (*28*), and human health (*29*). Effective biosecurity and an immediate reduction in wildlife trade are urgently needed to reduce the risk of pathogen spread. As mitigation of chytridiomycosis in nature remains unproven (*30*), new research and intensive monitoring that utilizes emerging technologies are needed to identify mechanisms of species recovery and develop new mitigation actions for declining species.

http://science.sciencemag.org/content/363/6434/1459

NUNS BREED ENDANGERED SALAMANDERS

Chester Zoo, Michoacana University of Mexico, a Mexican government fisheries centre and a group of Mexican nuns teamed up to develop a breeding programme for the Lake Pátzcuaro salamander and ensure the continued survival of this critically endangered species!

The salamanders once thrived in Lake Pátzcuaro, Mexico's third largest lake, but are now listed as critically endangered by the International Union for the Conservation of Nature (IUCN). The species is of great importance to the locals who have lived alongside it for hundreds of years but the latest research has led to fears that fewer than 100 individuals may remain. However, the new breeding plan is now aiming to boost numbers and, in time, re-energise the wild population.

A combination of introduced exotic fish and destruction of forest which has altered the shoreline of the lake has pushed these salamanders to the brink of extinction, forcing the nuns to breed the salamanders in their convent to keep alive both the species and their traditions. Experts believe the population being kept by the nuns will play a key role in any future reintroduction back into the wild.

Lake Pátzcuaro salamander fast facts: Scientific name: *Ambystoma dumerilii*

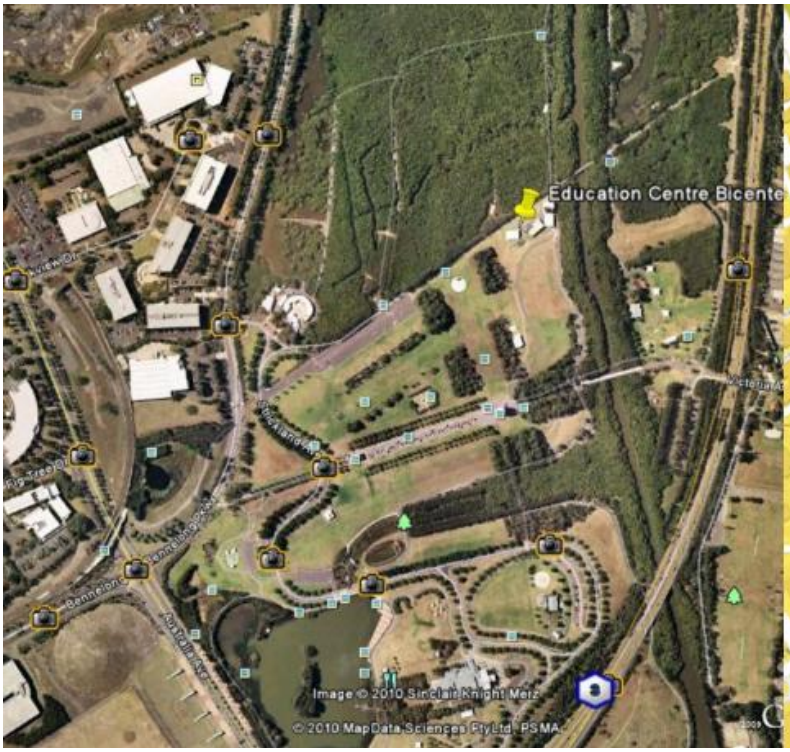
The surviving wild population is very small. Although populations are difficult to assess, recent surveys covering almost all of its known distribution range have usually captured fewer than 100 individuals

The species does not metamorphose and lives permanently in water

Up to 20 tonnes of the 'achoques', by which they are known locally, were taken from the lake in as recently as the 1980s. But by the early 1990s, hardly any remained.

https://youtu.be/YfRMhBzkUbE
https://www.chesterzoo.org/whats-happening/zoo-news/2018/06/worlds-rarest-amphibians and https://video.nationalgeographic.com/video/news/00000164-0504-dd1e-a56d-9d5fb52c0000?source=searchvideo

FATS MEETS AT THE EDUCATION CENTRE, BICENTENNIAL PARK, SYDNEY OLYMPIC PARK



FATS MEETINGS commence at 7 pm, (arrive from 6.30 pm) and end about 10 pm, at the Education Centre, Bicentennial Park, Sydney Olympic Park, Homebush Bay. They are usually held on the **first Friday of every EVEN month** February, April, June, August, October and December. Call, check our web site, Facebook page or email us for further directions. We hold 6 informative, informal, topical, practical and free meetings each year. Visitors are welcome. We are actively involved in monitoring frog populations, field studies and trips, have displays at local events, produce the newsletter FROGCALL and FROGFACTS information sheets. FATS exhibit at many community fairs and shows. Please contact Events Coordinator Kathy Potter if you can assist as a frog explainer, even for an hour. No experience required. Encourage your frog friends to join or donate to FATS. Donations help with the costs of frog rescue, student grants, research and advocacy. All expressions of opinion and information in FrogCall are published on the basis that they are not to be regarded as an official opinion of the FATS Committee, unless expressly so stated.

FATS ON FACEBOOK: FATS has over 2,650 Facebook members from almost every continent. Posts vary from husbandry, disease and frog identification enquiries, to photos and posts about pets, gardens, wild frogs, research, new discoveries, jokes and habitats from all over the world. The page includes dozens of information files. https://www.facebook.com/groups/FATSNSW/

RESCUED FROGS are at our meetings. Contact us if you wish to adopt a frog. A cash donation of $30 - $50 is required to cover care and feeding costs. Sorry we have no EFTPOS. FATS must sight your current amphibian licence. Licences can be obtained from NSW National Parks and Wildlife Service, Office of Environment and Heritage (link below). Please join FATS before adopting a frog. This can be done at the meeting. Most rescued frogs have not had a vet visit unless obviously ill. Please take you new, formerly wild pet to an experienced herp vet for an annual check-up and possible worming and/or antibiotics after adoption. Some vets offer discounts.

http://www.environment.nsw.gov.au/wildlifelicences/GettingAnAmphibianKeepersLicence.htm

FATS now has Student membership for $ 20 annually with Electronic FrogCall (but no hard copy mail outs).
https://www.fats.org.au/membership-form

Thank you to the committee members, FrogCall supporters, talented meeting speakers, Frog-O-Graphic competition entrants, events participants and organisers David, Kathy and Harriet Potter, Sarah and Ryan Kershaw. The FrogCall articles, photos, media and webpage links, membership administration and envelope preparation are greatly appreciated. Special thanks to regular newsletter contributors, Robert Wall, George Madani, Karen & Arthur White, Andrew and David Nelson, Josie Styles, Wendy & Phillip Grimm and Marion Anstis.

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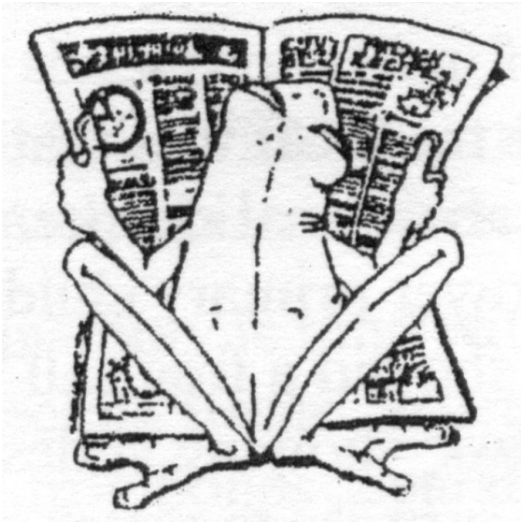

FATS FIELD TRIPS

Our 2019/20 fieldtrips program re-commences in September 2019. Let Robert Wall know if you are hoping to attend a future trip. We would love photos and stories from any of our previous events. Please send them to Monica Wangmann's email address. See page 11.

FATS AGM - FRIDAY 2 AUGUST 2019

The FATS AGM will be held on Friday 2/8/2019, commencing 7pm. FATS meets at the Education Centre, Bicentennial Park, Sydney Olympic Park.

If you would like to ask any questions about joining the FATS committee, please give us a call. Contact our President Arthur White at least two weeks before the meeting for further information and to submit items.

We appreciate fresh ideas and new members on our committee. No experience required. The committee meets 6 times a year. No task commitments or time expected of committee members, other than what you are able to spare. See contacts details on page 11.
Arthur White

2019 FATS FROG-O-GRAPHIC COMPETITION

The FATS members' 2019 Frog-O-Graphic competition opens 1st May and closes 31st August 2019.

Categories: Best Frog Image,
Best Pet Frog Image,
Most Interesting Image &
People's Choice.

Category winners are decided by a panel of judges.

People's Choice is voted for by everyone present at the October FATS meeting.

All entries are by email to photos@fats.org.au

Please state: your name, confirm that you are a financial FATS member, **identify the frog species preferably by scientific name (in the file name) and location**, if known, whether the image is a pet frog and your contact phone number.

Max 6 entries per person. Max attachment size 6 MB.

Fabulous prizes awarded. Entries must be original and your own work. The entries may appear in FrogCall, Facebook, our web site and other FATS publications.
Arthur White

HAVE YOU COMPLETED YOUR APRIL ANNUAL AMPHIBIAN PET 2019 RETURN?

Your amphibian keepers return for pet frogs was due by 30 April. Some native frogs can be kept as pets in New South Wales, as long as you have a NSW State licence. The only non-native (exotic) amphibian that can be kept as a pet without a licence is the axolotl, *Ambystoma mexicanum*. All other non-native frogs and amphibians cannot be kept as pets because they may become invasive and spread disease. See the NSW Office of Environment and Heritage web site link below.

It's against the law to take frogs or tadpoles from the wild or release unwanted ones. Taking animals from the wild, or even your backyard, can cause local extinctions. Dumped frogs can spread disease, starve to death or be killed by other animals. Pet native frogs must be bought from licensed animal keepers or though FATS frog rescue.

Licensing helps protect our unique native frog species and their ecosystems and keep animals safe. Tadpoles must never be collected from national parks or other reserves. When tadpoles have turned into froglets they must be released at the place where they were collected.

See http://www.environment.nsw.gov.au/licences-and-permits/wildlife-licences/native-animals-as-pets/frog-keeper-licences