

# FROG CALL

THE FROG AND TADPOLE  
STUDY GROUP OF NSW INC.

NUMBER 39 - January 1999

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Sydney South NSW 1235

INTERNET HOMEPAGE [http://members.xoom.com/frog\\_group](http://members.xoom.com/frog_group)

THE NEXT MEETING 7 00 PM, FRIDAY 5<sup>th</sup> February 1999 for a  
7.30 pm start at the AUSTRALIAN MUSEUM (WILLIAM ST ENTRANCE)  
If coming by vehicle allow extra time to find parking.

## SPECIAL NOTICES

FATS Membership renewals are due by 1<sup>st</sup> June 1999. The June '99  
Herpetofauna can only be ordered for those who have paid for 99/00.

& Join us at Smiths Lake Field Station. Come frogging.- see page 2.



Smiths Lake Field Station



## MEETING FORMAT for 5<sup>th</sup> February 1999

- 7:30pm Guest speaker:  
Frank Lemckert (State Forests)  
Frog Sex and other Dirty Business
- 8:15pm 5 favourite frog slides or 5 minutes
- 8:40pm Raffle and Auction
- 9:00pm Finish for tea, coffee & biscuits

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with compliments  
Katherine Wangmann



**CRYOPRESERVATION, REPRODUCTION AND TADPOLE DEVELOPMENT**

A well attended December Frog And Tadpole Study Group meeting at Australian Museum's the Hallstrom Theatre, saw Robert Browne discuss research on cryopreservation, frog reproduction and tadpole development.

So why is cryopreservation important? The decline in numbers of frogs will lead to inbreeding, which in turn leads to reductions in disease resistance and reproduction efficiency and an increase in genetic defects and rates of extinction. A minimum population size to negate inbreeding requires a colony of 50 adults of each sex. In captivity, keeping 100 frogs of endangered species would be an expensive task however keeping one female and the cryopreserved sperm of 50 male frogs would not only be more secure but lower costs. Many endangered frog populations in the wild are already less than 100 adults and storage of sperm could prevent inbreeding. This technique has been successfully used for fish such as sturgeon and birds.

Newcastle University is the first in the world to have successfully preserved amphibian sperm. Hopefully techniques will soon be developed that allow the cryopreservation of tadpoles. Studies are also being carried out on density and nutrition effects on pond tadpole growth and development. These studies will help develop methods for the mass rearing of tadpoles for conservation and may help explain tadpole ecology.

Tadpoles and metamorphs are the most vulnerable stage of a frogs life cycle. With no swim bladder or pectoral fins, tadpoles are very vulnerable to invertebrate and fish predation.

Frogs use a variety of techniques to help tadpoles and metamorphs survive predators. These include, guarding of eggs, pouched frogs which keep tadpoles safe until they metamorphose, the gastric brooding frog or in isolated ponds frogs lay eggs in bromeliad plants, which hold water, in tropical forest trees. The degree of parental care corresponds to a lower egg production.

Another technique is to lay large numbers of eggs in ephemeral ponds without parental care. Frogs breeding in very ephemeral ponds, such as dry sandy areas or rainforest pools, avoid severe tadpole losses by developing rapidly and overwhelming resident land predators with synchronous metamorphosis. Other frog species, in ponds of unpredictable ephemerality, use asynchronous metamorphosis to hedge their bets with land conditions, some tadpoles developing early and some late.

Past experiments on tadpole development have supported ideas that there are interactions between tadpoles that result in differences in size at metamorphosis. This model restricts the transfer of results from captive to wild tadpoles and restricts the mass rearing of tadpoles due to density restrictions with associated costs. These results could be biased by food

chemicals in the water. Tadpole density is an important effect in this model. It would be interesting to separate raising conditions in captivity from natural factors such as heredity deciding development. Protein availability in early development has been shown to decide the time of metamorphosis and in the later development stages the size at metamorphosis.

We fed tadpoles at high densities (60/Litre) high protein feed with 12 hr. water changes. Using this method the Ornate burrowing Frog (*Limnodynastes ornatus*) and the Red-eyed Tree Frog (*Litoria chloris*) took about 34 days to metamorphose and all tadpoles changed over four days. These are an example of frogs using very ephemeral ponds.

In contrast with the Green and Golden Bell frog (*L. aurea*), an unpredictable ephemeral pond breeder, most tadpoles took 45-84 days to metamorphose and 15% had not developed legs or metamorphosed at this time. Survival was almost 100%. These results are in contrast to other experiments, and pave the way for mass rearing of endangered frogs for release or experimentation. Also this method gives optimism for the uncoupling heredity and natural development from rearing condition.

Tadpole development studies may give clues to the strategies of frog reproduction and the reproductive strategies of frogs in the wild instead of waiting years to observe them in their habitats - (if you can find them). A range of genetic programming can be observed. Thank you Robert for frog slides, the thought provoking insight into current frog research, (and reviewing and editing this article).

Frog call CD's and tapes sales raised \$200, jewellery sales \$179, and guessing competition \$95, won by Margot Gover ticket E43, (Margot and Ken regularly donate lovely frog auction items). Lothar Voigt ran our auction and provided us with updates on a variety of Froggy issues and happenings.



**FROGGING AT SMITHSLAKE FIELD STATION 18 TO 22 FEB 1999**



Arthur White has booked accommodation at Smiths Lake Field Station, (which fronts onto a sandy lake foreshore), for a nightly froggy walk, to trails such as Sugar Creek Flora Reserve from the 18th to 22nd February 99. Last years trip was very successful and fun for all. Contact Arthur on 9599 1161, to confirm the numbers of people and days you will be there. \$10 per person per night. Mostly dormitory accommodation. Beds, hot showers, flush toilets, fridges, kitchen tables, chairs and urn there. Bring your own sheets, blankets or sleeping bags, pillows, towels, toiletries, plates, cutlery, food and drink. Smith lake is suitable for canoes and swimming.



## FROGBITS & TADPIECES

**F**ROG POND COURSE (1 day), Study and Care of Reptiles and Frogs (2 days), Living with Elapids (2 days), Colo Wilderness field work (2 days), Aquarium Technology (2 days). Ring Lothar on 9371 9129.

### BITTEN BY THE FROG:

This is the first time I actually got bitten by a Striped Marsh Frog. More startling than painful, but it made me drop him again. What do they do under their spawn clumps anyway? Boasting? Has anybody ever seen them doing anything useful there, like keeping predators away? Anybody ever put some fish into the aquarium to see what he does? Or put some more females in? - In froggy weather I get up to six spawn clumps overnight on my pond, and the next night another six. Does that mean that the minimum population density is at least 12 adult pairs, or maybe 12 females and six males? (Trouble is, they sound more like 60 of them when they're going full bore. They all seem to be yelling for the few females that still have any spawn in them. Tomorrow I'm going to turn the rocks over and prod the females in the sides. I bet most of them are empties. I really should put a few more frog feeders out.)

### MANLY OCEAN CARE DAY

on 6<sup>th</sup> December would not have been the same without the FATS stand. Elisabeth, Richard, Noelene and half of me had a glorious day, interesting folk to talk to and good frog propaganda to hand out.

### AUSTRALIAN REPTILE PARK CHRISTMAS PARTY

was also on 6<sup>th</sup> December (which is why I split myself in half to get there). A great success, as every year! Many thanks, Robyn and John, for having invited the FATS Group over.

### VOLUNTEERS NEEDED

for the Easter Show. We won't have the cats' pavilion again, but there's more than one way to skin one. Please ring me on 9371 9129. Be bold - be a Frog Explainer! Or just be there. We need lots.

### WHAT'S GREEN AND GOLDEN AND RED?

Sadly, it's road-killed Bell Frogs, and quite a few of them on a 400 m stretch of road around the Homebush Bay Brick Pit. Warren Beattie took a good look at them, after a downpour on 18<sup>th</sup> January at night. What can be done? Put up signs and better frog fences? Will the frog juice on the tyres on the wet roads infect other populations with Chytrid Fungus?

SO MUCH FOR HIM WANTING TO BE PRESENT DURING THE BIRTH.



## WHAT'S CROSSED THE ROAD FROM FLEMINGTON MARKETS?

On 20<sup>th</sup> January I was called out to rescue a Green Tree Frog from Homebush West. The house, as it turned out, was on the other side of the road from the Markets, straight opposite, and the frog had been in and out of the house for the last three weeks. The scary bit is that it's only a short hopping distance from the Brick Pit, and that's a Fungus area. - Arthur and I are already tightening up our quarantine procedures. L.V.

### LITORIA NASUTA (ROCKET FROG)

If FATS members come across any good localities where *Litoria Nasuta* are breeding, call Monica on 9797 6543.

### TRIVIA

It was discovered on a space mission that a frog can throw up. The frog throws up its stomach first, so the stomach is dangling out of its mouth. Then the frog uses its forearms to dig out all of the stomach's contents and then swallows the stomach back down again. With compliments Martyn Robinson

### PHD SCHOLARSHIP ON DECLINING FROGS

We are looking for a suitably qualified person (BSc honours or equivalent) who wishes to study for a PhD on aspects of the declining frog problem. A scholarship is available (about \$20,000 annually) and the student would be based at the University of Newcastle. The student would join a small team working on various aspects of the declining frog problem in Australia. The project is focused towards the Green and Golden Bell Frog (*Litoria aurea*) but this would not limit wider interests.

If you are interested contact Michael Mahony at bimjm@cc.newcastle.edu.au or phone on 02 4921 6014.

**ERRATUM:** Last Frogcall's joke "All the President's Frogs" was actually from our co-editor Carl Spears.

Have a look at our new FATS HOMEPAGE  
[http://members.xoom.com/frog\\_group](http://members.xoom.com/frog_group).

**I'M A STUDENT OF TROPICAL BIOLOGY,** at the Universidad Nacional, Heredia, Costa Rica, but right now with the Appalachian State University USA. My research interest are systematics, evolution, ecology and behavior of snakes, but also herpetofauna. I would like to spend some time working as a volunteer in a herpetological conservation project. Can you send me any information? Mauricio Solis Appalachian State University USA Ph (828) 266-6761 Fax (828) 262-4037 ICQ #18727265 e-mail ms31877@appstate.edu, snakemau@hotmail.com with compliments Martyn Robinson, Liz Maher and Nature Conservation Council.

READ NEXT FROGCALL FOR DETAILS ON THE 50<sup>TH</sup> ANNIVERSARY CONFERENCE OF THE AUSTRALIAN HERP. SOCIETY



## BANANA BOX FROGS FOR OUR MEMBERS

The first of the FATS Group's tree frogs from Flemington Markets are now out of quarantine and ready to be distributed amongst our members. You may recall Monica's article in the last issue. In a nutshell, it's this:

- Frogs that come as stowaways in boxes of bananas or other produce are sometimes collectively called banana box frogs. Most of them are Dainty, Common Green, White-lipped, Red, Bleating, Dwarf and Emerald-spotted Tree Frogs. All these species are still common.
- These translocated frogs are classified by us as unreleaseable, because we don't want to see them turned loose in an area where they don't belong (especially if a different strain of the same species already lives here) and because we can't send them back, not knowing their precise origin with any certainty. Also, dragging frogs around between any Chytrid Fungus infected areas could be a disaster for other frogs.
- Last November the FATS Group bought 48 clear plastic tanks, and we'll soon need more. Monica left half of them with the banana wholesalers at the Markets (who have been unbelievably supportive - they never liked putting them out on the skip with the cabbage leaves). The other half are for transporting and quarantining the frogs.
- Monica or at times her helpers collect them every week and take them to Arthur and to me for a quarantine period. During the first month they stay separate from other frogs that have joined quarantine earlier or later, and we also keep the sizes separate. They are then combined into larger cages, and are finally taken to the next FATS meeting, for handing out to our members.
- Now, you may ask, how can the FATS Group afford to pay for all the heatable cages and all the crickets? This, dear member, is where your kind donation comes in. For a large frog (Common Green Tree Frog or White-lipped Tree Frog) we expect a donation of \$25 out of you. For a medium-sized one (which includes the Dainties) we'd like \$15, and for a small one \$5. These are donations, not prices, because we have hang-ups about "selling" our totem animals. Just bear with us. But if we can't cover costs, we'd need to fold the project up again.

## Lone frog to get Swedish lovers

**LONDON:** The last known surviving male British pool frog is to have nine girlfriends flown in from Sweden in an effort to boost his love life and save the species from extinction.

The pool frog will be encouraged to breed with his Swedish cousins, who have been chosen because they have the closest genetic make-up to the British variety.

Scientists are hoping the pool frog will prove to be an unfaithful toad: the amphibian lives for an average 17 years, and as a seven-year-old the male has the chance of fathering scores of litters in his lifetime.

The reason for the demise of the frog - which is about the size of a normal frog but has a bronze back and gold or green eyes - is largely unknown but several factors are suspected, such as a reduction in suitable habitat and the increased numbers of predatory water birds.

So if you want a tree frog, here's the procedure:

Make sure you're a member of the FATS Group.

If you don't have an Amphibian Keeper's Licence, get one from National Parks & Wildlife Service (phone 9585 6444). Costs \$40 for 2 years and covers all and any of the common species.

Put your name on the waiting list at the next meeting. The list will be on the table from the beginning of the meeting onwards.

At the end of the meeting, FATS will issue frogs to those on the waiting list, starting from the top, who have a licence and have their licence number with them, and who also have their donation with them.

Your frog will be issued to you in a plastic bag, so you don't need to bring a container.

You can choose which frog - first ones on the list having first go.

You can only get one frog at a time, but you can join the list again next time.

Please put your frog into a larger container or a proper cage as soon as you get home. The next day (unless you have already done so), organise a proper cage for it. (Suitable frog cages may also be available at meetings, together with instruction sheets.)

Remember your frog is unreleaseable. If you cannot keep it, find a new owner for it or take it back to the FATS Group. For the first six months, you're stuck with it anyway - that's a condition of your licence. (If you just wanted something to release in your garden pond, this project is not for you. Get FATS or FATS members to give you some Striped Marsh Frog taddies instead. You won't even need a licence then.)

Should you ever breed with it, or with any other frogs of mixed or unknown origin, then you should consider the offspring also as unreleaseable.

A small final thought: Some people with a solid interest in frogs, as well as many animal welfare people, don't agree with keeping frogs in captivity at all. It's a complex subject, maybe a bit less complex here where homeless, unreleaseable frogs are concerned, but you won't convince everybody. For their and your peace of mind, let alone for the good of the frog, please keep its cage and its water really clean, and don't have its cage absolutely minuscule. L.V.

## Frogs hold the line

30-10-98  
Daily Telegraph

Tyre manufacturers could leap ahead of the competition by copying the toe pads of tree frogs, claims a British expert.

The advice comes from a British zoologist who has studied the ability of 14 species of Trinidadian tree frogs to hang upside down on glass surfaces.

Jon Barnes, of the University of Glasgow, found that heavier frogs hung on for longer than expected, and had twice as much adhesive force in their intricately patterned toe pads than the lighter species.

In *New Scientist* magazine Dr Barnes said: "Their ability to hang on surprised me."

"The pattern of the toe pads might enable us to redesign vehicle tyres to improve their road-holding ability in wet conditions."

A Dunlop Tyres spokesman Geoff Stewart told *New Scientist* that an understanding of how tree frogs cling to surfaces could well be applied to tyres.

"It could act as a catalyst for an inventor," he said.





PERON'S TREE FROG

## MY MOUNTAIN FROG POND

In 1990 my husband and I decided to leave the burgeoning city of Gosford and move to a more pastoral location. We purchased some land further north on the Comboyne plateau. We chose the Comboyne area because it was close to the large towns of Taree and Port Macquarie where my husband could work, but more importantly, it boasted magnificent views over the coastal plain and was surrounded by remnant rainforest. In this ideal location we built our house and tried to become familiar with the local residents (human and non-human). We deliberately left a lot of bush close to the house so that we could enjoy the birds and wallabies and frogs. The birds and the wallabies were regular guests but the frogs were conspicuously absent.

In the following years I made a number of trips to nearby creeks, dams and swamps to try to collate a list of the local frogs. I found this frustrating and difficult but eventually I was able to prepare a list of the frogs of East Comboyne (see below)

### East Comboyne Tree Frogs:

- Red-eyed Tree Frog *Litoria chloris*  
Common in dams and creeks
- Peron's Tree Frog *Litoria peronii*  
Occurs mainly around farm dams
- Leaf-green Tree Frog *Litoria phyllochroa*  
Occurs in smaller creeks

### Ground Frogs: Barred River Frog *Mixophyes fasciolatus*

- Present in two streams only
- Stuttering Frog *Mixophyes balbus*  
In Marsh State Forest
- Striped Marsh Frog *Limnodynastes peronii*  
Present in many dams
- Eastern Banjo Frog *Limnodynastes dumerilii*  
Present in some dams
- Sphagnum Frog *Kyrranus sphagnicolus*  
In Marsh State Forest & Boorgan Nature Reserve.
- Fletcher's Frog *Lechridous fletcheri*  
In rainforest areas
- Common Eastern Froglet *Crinia signifera*  
Farm dams, small creeks and bogs.

My efforts at frog surveying were worthwhile but I was frustrated. I was living next to rainforest and I did not have a single frog within hearing or visual range. I had expected to have frogs of all sorts about the house and living amongst the plants and ferns. Finally, I decided that I needed a frog pond close to the house.

In 1996, my husband and son collected rock and soil to construct a basin that would hold the pond. The pond would

be small, only 2 metres in diameter and 40 cm deep. It was lined with a plastic liner and lots of rocks and small plants were ground around the banks. When it was finished we sat back to wait for the frogs to arrive.

A year passed- no frogs. In the meantime, the pond had developed into an algae-infested cesspool that was only fit for mosquito wrigglers to live in. This was a disaster, either the pond had to go or it had to be miraculously reinstated to a viable frog pond.

We sought advice about what to do - and we received plenty. It was put to us that there was not a great deal of difference between a healthy self-sustaining pond and a cesspool. Our pond was totally dominated by one type of algae which grew out of control. The best way to control it was either to keep removing algae from the pond and opening up clear water areas (too much hard work) or use freshwater snails to crop the algae. In mid-1998 I purchased some snails from an aquarium wholesaler at South-West Rocks and placed them into our pond. The transformation was astonishing.

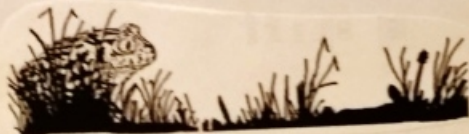
The snails bred quickly and munched through the algae at a colossal rate. Patches of open water appeared. We added a few other type of aquatic plant to the pond and the pond continued to change. The water was clear and the plants bloomed.

Imagine our surprise when in August frogs began to sing from the pond. The first sounds were a raucous, wailing noise. I quickly found a torch and rushed out to the pond. The first frog that appeared in the torch beam was a beautiful green frog with bulging orange eyes (a red-eyed tree frog). Over the next few weeks that solitary male frog was joined by others of his ilk. Their calling became a constant part of the evening background sounds.

Excitement levels rose even higher when in October tadpoles were seen in the pond. They had to be tadpoles of the Red-eyed tree frog as these were the only frogs that had found our pond. We looked for juvenile frogs but have never seen any. Spawning occurs weekly and there is a host of tadpoles of various sizes in the pond. Night calling has been deafening at times.

In late December, Arthur White visited our hide-away. One evening he pointed out that some tadpoles were behaving strangely. We all went out to look. Large tadpoles were rising directly underneath a recent spawn mass and pulling at it, tearing off pieces of the jelly coat and eating it. Some tadpoles would grab a mouthful of the jelly and swim downwards, causing the jelly to tear and form thin strands. The tadpoles would suck in the jelly coat but leave the eggs which fell to the bottom of the pond. This behaviour is apparently not usual tadpole behaviour and Arthur photographed tadpoles tucking into the spawns. This feeding continued the next morning until all of the spawn had been torn apart.

I love my frog pond. I love the noise and activity that goes on around it. I feel contented and happy to have so many froggy guests. Perhaps I should put in another.  
Sue Scott-Orr, forwarded on by Arthur White





## FROG DECLINE & EXPANSION OF HUMANKIND ANOTHER PESTICIDE SURPRISE

**T**he decline and disappearance of frog populations worldwide remains a mystery, despite efforts by hundreds of scientists to determine the causes. The other major problem facing frogs is massive deformities observed since 1995 among frog populations in California, Iowa, Minnesota, Missouri, Ontario, Quebec, South Dakota, Texas, Vermont, and Wisconsin is now better understood.

During the past six months, press interviews with research scientists, and published studies, have shed a bit of light on both problems though true consensus has not yet emerged on either one. No one is even sure whether the two problems are connected, though new evidence indicates they are. Some scientists still doubt that frogs are actually disappearing worldwide. They prefer to believe that the simultaneous declines and disappearances of frog populations in North and South America, Europe, and Australia reported since 1980 are nothing more than the normal ups and downs of any wild population. However, SCIENTIFIC AMERICAN said in August that the "majority viewpoint" among scientists now is that the widespread declines and disappearances are "highly abnormal".

"I think we're close to consensus now," says David Wake, a well-known frog researcher at the University of California at Berkeley. There are roughly 5000 species of amphibians worldwide. Of these, 242 inhabit the U.S. A recent study by the Nature Conservancy and the Natural Heritage Network identified 92 of these 242 (or 38%) as endangered, imperiled, or vulnerable (meaning they are likely to become extinct within 5, 20, or 100 years if present trends continue.) James La Clair at the Scripps Research Institute in La Jolla, California, says, "Although amphibians have lived on this planet for over 300 million years, nearly 120 times as long as modern man, reports within the last three decades have shown that numerous amphibian species are either suffering from serious population loss or have disappeared altogether. La Clair says there are very likely "a collection of causes," but one way or another they can all be traced back to "the expansion of humankind."

Loss of frog habitat, chiefly wetlands, is probably the biggest single cause. Global warming and accompanying droughts may contribute because frogs develop from eggs that thrive in water. The artificial stocking of streams with trout and bass plays a role, too. Pesticides and other chemicals certainly exacerbate the problem (more on this below). Laboratory experiments have shown beyond doubt that ultraviolet light from the sun can interfere with the development of frogs' eggs. Acid rain may contribute to the problem as well. Humans eating frogs' legs in large quantities are not helping. And there are other causes, such as infectious agents.

A group of Australian researchers reported this summer that they have identified one particular fungus that is killing frogs in locations as far apart as Queensland, Australia and Panama in Central America. The fungus which has never before been reported to harm any vertebrate species causes changes in the skin of frogs, somehow contributing to their deaths. The mechanism is not understood, but frogs breathe oxygen through their skin and the fungus may cause suffocation.

No one knows why an ancient fungus would suddenly start killing frogs in places as far apart as Australia and Panama. It is conceivable that the fungus was transported to these places only recently on the boots or equipment of researchers studying the disappearance of frogs. Another possibility is that the fungus has been present in these locations for a long time but frogs are now succumbing to it because their immune systems have been impaired by recent changes in the environment.

One candidate would be increased ultraviolet light, which is well-known to damage the immune systems of many animals, including frogs. In recent years, chlorinated chemicals released by humans have thinned the protective layer of ozone in the upper atmosphere, thus allowing about 10% more ultraviolet light from the sun to reach the surface of the Earth. Certain industrial chemicals released into the environment may also be damaging the immune systems of frogs.

One particular class of chemicals called retinoids has come under strong suspicion because retinoids can cause severe birth defects in many animals, including frogs and humans. The medicine Accutane, prescribed for treating acne, is a retinoid known to cause major birth defects in humans.

The deformities now being found in large numbers of frogs at many locations in the U.S. and Canada are grotesque. Herpetologists scientists who study amphibians and reptiles have reported finding frogs with missing legs, extra legs, misshapen legs, paralyzed legs that stick out from the body at odd places, legs that are webbed together with extra skin, legs that are fused to the body, and legs that split into two half-way down. They have also found frogs with missing eyes and extra eyes. One one-eyed frog in Minnesota had a second eye growing inside its throat.

Dr. David Gardiner, a research biologist at the University of California at Irvine, has been studying retinoids for at least a decade, and in recent years he has probed frog deformities. To him, retinoids are the obvious culprit in the mystery of the misshapen frogs because of the peculiar kind of limb deformities being observed. "There is no other known mechanism for this [besides retinoids]" Gardiner says. "Much of early development is controlled by retinoids," he says. "Our body [and the body of a frog] is completely dependent on them," he told a reporter. Exposure to retinoids could also make frogs more susceptible to infectious diseases, Gardiner says: "The kinds of chemicals that



would target development of limbs would target all organ systems,\* including the immune system. Frogs with abnormal legs would also very likely have abnormal immune systems. This could explain why some frogs are now suddenly falling victim to infectious agents that they resisted for millions of years.

James La Clair and his associates at the Scripps Research Institute in La Jolla, California, recently showed that a popular anti-mosquito insecticide, called S-methoprene, breaks down in the environment to several different kinds of retinoids. Under laboratory conditions, La Clair was able to show that the ultraviolet light in sunlight causes S-methoprene to break down into half a dozen retinoids, and that these retinoids in turn can cause frog deformities of the kind being seen now in the U.S. and Canada.

S-methoprene was introduced in the 1970s to control mosquitoes, which breed in water. It is sold under trade names like Altosid, APEX, Diacon, Dianex, Kabat, Manta, Minex, Pharoid, Precor, Yuvemon, and ZR 515. It is also widely sold in flea powders. La Clair calculates that the amount of flea powder used to treat a ten-pound pet one time contains enough S-methoprene to contaminate 110,000 litres of water to a level that would cause deformities in frogs. S-methoprene is also widely used in agriculture to treat cattle grazing areas, tobacco, and certain grain crops. It is also sometimes added to cattle feed. S-methoprene mimics a hormone that inhibits developing pupae from molting; thus it is known as an "insect growth regulator." Because vertebrate species do not have a pupal stage of growth, scientists assumed S-methoprene could not harm amphibians or mammals. When fed to mammals, S-methoprene is about as toxic as sugar. Now La Clair's work has shown that this seemingly-harmless chemical can be transformed into a potent teratogen by exposure to sunlight for just a few hours.

The implications of this research, which was reported in ENVIRONMENTAL SCIENCE & TECHNOLOGY, a journal of the American Chemical Society, are profound. For one thing, it means that once again the pesticide regulators at U.S. Environmental Protection Agency [EPA] have missed a key feature of a chemical whose safety they regulate. Secondly, it shows once again that relying on risk assessment leads to bad public health decisions. EPA's risk assessments have routinely failed to evaluate the breakdown by-products of the pesticidal chemicals that the agency has deemed safe enough to allow as residues on our dinner plates. Third, it means that thousands of pesticides now in common use need to be re-tested to see if their breakdown by-products are dangerous to humans or other species. However, this additional testing is unlikely to occur any time soon because EPA currently estimates that it is at least 15 years behind schedule in safety-testing the pesticides to which we and the frogs are currently being exposed.

Indeed, the situation is worse than the agency makes it out to be. Congress ordered EPA to re-evaluate and

demand that the agency complete the job by 1977. Since 1972 the Agency has been doing its best to comply, but each year new revelations have come to light, new evidence showing that pesticides can harm humans and the environment in ways that no one imagined, so additional tests have been required.

Thus La Clair's work is just the latest surprise in a long chain of unpleasant surprises. EPA officials in 1996 estimated that they will complete their pesticide safety re-evaluations (which they were ordered by Congress to complete in 1977) in the year 2011 -- 34 years late -- IF they can keep the work on schedule.

Meanwhile the frogs and we continue to be exposed to thousands of poorly-understood government-approved industrial poisons. In sum, Dr. La Clair's research into the deformed frogs of North America serves to remind us that pesticides are now too dangerous to be safely regulated, even by the most powerful government the world has ever known. Or is it that PESTICIDE MANUFACTURING CORPORATIONS are now too dangerous to be safely regulated, even by the most powerful government the world has ever known? It's a fair question.

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Arcadia Berowra

Galston Mt. Kuringai

Dural Hornsby

Berowra Valley Regional Park

Berowra Valley Regional Park, bounded by Hornsby, Dural, Pennant Hills and the Hawkesbury River, will get \$1 million in annual funds.

Red-crowned toadlet

Giant burrowing frog

Sun Herald 22-11-98

7

RITTLE



## CHYTRID FUNGUS UPDATE

We have prepared an update about research on the chytrid fungus. Since we reported the occurrence of the amphibian chytrid fungus in frogs from Australia and Panama (Berger et al. 1998. PNAS 95: 9031-9036.) the amphibian disease group has continued to investigate the role of this pathogen in frog disease in Australia. The group has examined ill and dead amphibians as well as surveying archived frogs and clinically normal frogs. The comments below are based on these studies. Our Amphibian Disease home page has data relevant to Australia, <http://www.jcu.edu.au/dept/PHTM/frogs/ampdis.htm>. I think there is a lot to be done on the chytrid fungus issue and that this is an extremely high priority, particularly in determining whether or not the fungus is everywhere and if frogs that are dying from it are immunosuppressed from some other stress.

The amphibian chytrid fungus is very widespread, and occurs in almost all the areas where sick/dead frogs have been collected. The known distribution includes many areas of eastern Queensland between Brisbane and Cooktown, Eastern NSW, Central highlands of Victoria, Adelaide and Perth. This distribution may be a reflection of searching intensity. We have not examined frogs from NT, northern WA, or vast areas of central Australia. Infected frogs have been found from 23 species, including 7 threatened species. Data on the species we have found infected with the amphibian chytrid and their locations is now available at the Amphibian Disease Home Page at <http://www.jcu.edu.au/school/phtm/PHTM/frogs/chyspec.htm>.

About half the 266 sick frogs submitted over the past 3 years were infected with the fungus. The infected frogs in general had no other significant disease, and in particular no evidence of depressed immunity with the exception of one frog. Infection with the chytrid fungus (chytridiomycosis) was the only cause identified in frogs we examined from almost all the mass die offs investigated.

A large range of diseases were found among the frogs sick or dead from diseases other than chytridiomycosis. Diseases identified include those caused by bacteria, protozoa, other fungi, tapeworms and tumours. Do we know or is it possible to know the extent to which the fungus occurs in healthy frogs? The group is currently doing two types of surveys in normal frogs, one to establish when the fungus arrived in each area (chronological survey), and another to determine current prevalence of the amphibian chytrid in areas where we know the fungus is present (prevalence survey).

**Chronological Survey:** We have been examining skin from archived frogs, collected when apparently healthy, to determine when the fungus first appeared in particular areas. This should allow us to track how long the fungus has been present in different areas. This survey is a large collaborative project, and we need the assistance of anyone with preserved frogs. From frogs preserved in formalin or ethanol we need skin from the thigh and some toes. We would like to receive frogs from any species or location, and will keep you informed of the results. Instructions for skin collection are on the WWW at

<http://www.jcu.edu.au/school/phtm/PHTM/frogs/pmskin.html> you have suitable specimens, please send them together with the details asked for on the web to Rick Speare, School of Public Health and Tropical Medicine, James Cook University, Townsville 4811, email [richard.speare@jcu.edu.au](mailto:richard.speare@jcu.edu.au) 136 samples have been examined, and chytrids were found in 3. The earliest record in Australia so far is a *Litoria genimaculata* from Kirrama Range, Qld, collected by Keith McDonald in 1989, and the other 2 were *Litoria spenceri* from Central Highlands, Vic, collected by Graeme Gillespie in 1996.

**Prevalence Survey:** This has just begun. We want to elaps from normal frogs to get an idea of how common the chytrid is. Is there a summary of what is being done and what is planned for work on the fungus?

**Work in progress on the chytrid includes-**

- 1) DNA comparison of cultured chytrid strains, by Jess Morgan at UQ. All isolates appear identical morphologically, so DNA analysis is required to detect differences between Australian isolates and also to overseas isolates. This work will help determine the origins of the fungus.
- 2) Culturing the fungus from different species and areas. We need to receive live, sick frogs to be able to grow the fungus, and would be grateful for any specimens that are found. Please contact Lee Berger ([lee.berger@dah.csiro.au](mailto:lee.berger@dah.csiro.au)) before sending live frogs. Instructions for submitting frogs are also on the web page <http://www.jcu.edu.au/school/phtm/PHTM/frogs/pmfrog.htm>

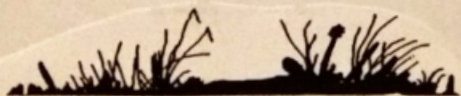
3) In vitro tests to find a suitable drug for treatment of captive frogs.

4) Disseminating information via the Amphibian Diseases home page at <http://www.jcu.edu.au/dept/PHTM/frogs/ampdis.htm>.

This site includes information on how to collect sick frogs for pathology tests, how to reduce the risks of spreading disease in the field, bibliography of frog diseases, a list of people with expertise in frog disease diagnosis as well as some information on the chytrid fungus eg. diagnosis, management in captivity.

**Work to commence soon includes-**

- 1) Transmission experiments to investigate pathogenicity of the fungus and how this varies with life stage, temperature, dose and species.
- 2) Treatment trials, to be conducted mainly by Gerry Marantelli, which will enable frogs to be collected from infected, declining populations and raised in captivity.
- 3) Evaluation and improvement of diagnostic tests. Researchers in America are also initiating many projects including DNA analysis, animal transmission trials and immunology. Lee Berger ([Lee.Berger@dah.csiro.au](mailto:Lee.Berger@dah.csiro.au)) CSIRO Australian Animal Health Laboratory Ryrie St, Geelong, Victoria 3220 Ph: 03 5227 5397 Rick Speare ([richard.speare@jcu.edu.au](mailto:richard.speare@jcu.edu.au)) School of Public Health and Tropical Medicine James Cook University Townsville, Queensland 4811





## FROG RESCUERS AT SYDNEY MARKETS

Many thanks to Marie, Elizabeth, Timothy, Jeremy and Greg Gillon, Mark Avery and Nerida Thiering, Claudia, Peter and Michael Hayes for your rescue work at Flemington Markets. We have also received a *Litoria dentata* who travelled from Bathurst with WIRES volunteer Merideth, when she drove down to Sydney to meet her son at the airport. MW

## WIRES

is always grateful for any spare frog spawn needing to be culled from your garden ponds. (Remember that each tadpole needs a couple of litres of water each so your pond will not support 1000's of taddies. Spawn can be used by WIRES volunteers to feed rescued tortoises. Contact Naomii on 9975 1633 for your nearest rescue centre. MW

## NOXIOUS POND WEEDS

Senegal Tea (*Gymnocoronis spilanthoides*) is the pond plant with the white pom-pom flowers that smell so nice. Well, it's been declared noxious in NSW, so you'll have to pull it out. Saintry and Jacob's book of Australian aquatic plants lists it as noxious in Queensland, because it can choke up waterways, but now it's in the bad books here too. There has even been one infestation in Tasmania.

Senegal Tea has hollow stems that can float on water and obstruct the flow. It dies back in winter, reshoots in spring and reaches up to 2 m height in summer. It also grows on damp soil without open water. It is in the highest (W1) category for noxious weeds, because, as the NSW Agriculture Noxious Weeds Advisory Officer explained, it can still be contained if a concerted effort is made.

A flowering sample and a full current list of noxious plants in NSW will be at the next meeting. To make your decision to throw your tea plant away a bit easier, you can pick up your free envelope with seeds of the "Green Goddess" Water Canna. The Green Goddess does not die back in winter, so your pond will be "green" whichever way and whenever you look at it. A big thank you to Ruth Sutton who brought the noxiousness of *Gymnocoronis* to my attention after the last meeting. L.V.

## BEROWRA VALLEY REGIONAL PARK

NSW Environment Minister Pam Allan recently opened Berowra Valley Regional Park. The park borders Hornsby, Dural, Pennant Hills and the Hawkesbury River. The 4 000 hectare park protects much bushland that is home to endangered animals including the giant burrowing frog.

The declaration of the parkland was due in part to a long conservation campaign by local residents. The park's area was due for development but the locals drew government attention to the park's conservation value. The park is the largest of the parks that ring metropolitan Sydney. The State Government will provide \$1 million in annual funds. With compliments Carl Spears

## CHYTRID FUNGUS IN BASS HILL!

Many thanks to Elizabeth and Mark from Bass Hill, who alerted the Frogwatch Helpline of frogs dying in their small garden pond.

As far as it could work out over the phone, the pond was fine. It's had a small population of Striped Marsh Frogs for years, but recently they started popping off - in a very terminal sense. The day before Elizabeth rang up, she found two dead males floating in the water, together with a lethargic live one, floating in broad daylight and bloated. There was no breeding activity at the time, no spraying had been done anywhere, and over the two weeks before, there had been two other corpses.

Elizabeth was kind enough to fish the two decomposing frogs out and put them in her fridge (the sick-looking one having somehow disappeared). She thought there was some skin haemorrhaging on the frogs. The next morning her husband Mark took them - packed with ice cubes - to the City, and sent them from there by taxi to Taronga Zoo.

At Taronga, the vet Dr Karrie Rose was expecting them. Decomposing though they were, she managed to get an identification of the pathogen: Chytrid Fungus, the killer that may be responsible for many frog declines, the fungus that looks like a protozoan and had the microbiologists fooled for so long. We know that there's Chytrid Fungus at Homebush Bay (yes, Homebush Bay) and now also at Bass Hill. If, as it seems, this frog fungus is new to Australia, our frogs may have little resistance to it. (If some Australian frogs do have antibodies against it, wouldn't that mean it's been here all along?) Elizabeth and Mark are keeping a close eye on their pond now. It could be useful to see how and if this disease runs its course in a small semi-isolated garden pond.

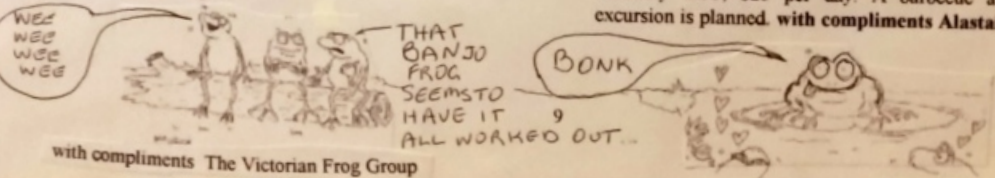
PS: All up, Elizabeth and Mark found about 15 dead frogs in their pond since October. No survivors appear to be left. The pond has been silent, even in the downpours and the warm weather over the last two weeks where my own pond has been deafening. L.V.

## QLD FROG SYMPOSIUM

The Queensland Frog Society and the Queensland Museum are holding a joint symposium on frogs at the Queensland Museum on the weekend of the 13th and 14th of February 1999. This symposium's aim is to bring together those with a general interest in frogs and scientists who work on frogs. There will be a number of presentations that celebrate the pleasure people have in frogs.

Four main areas of frog interest will be discussed, Community participation, Conservation management for Frogs, History of frog natural history in Queensland and Humans and Frogs.

Queensland Museum Theatre, Queensland Museum, corner of Melbourne and Grey Streets, South Brisbane, 13th & 14th February 1999, \$25 per day. A barbecue and frogging excursion is planned. with compliments Alastair Campbell



with compliments The Victorian Frog Group



## THE HARTFORD COURANT

**Scientists find more deformed frogs in Connecticut**  
(ASSOCIATED PRESS) In a deepening ecological mystery, state scientists have plucked four deformed frogs from a tiny wetland in Norfolk in northwestern Connecticut - the opposite corner of the state from a pond where numerous frog deformities have been documented since last year. But despite the new findings, early indications from an ongoing survey of 15 randomly picked sampling locations around the state show that the problem is probably not widespread in Connecticut.

The Connecticut survey is part of a nationwide search by scientists for answers to a 3-year-old mystery. They are trying to find what is causing the deformities and are concerned about the implications for people. If the culprit is a manmade chemical or natural substance, they wonder whether it could someday cause harm in humans.

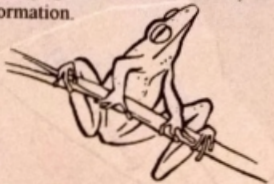
There were major deformities among four of 54 frogs [a high percentage for this type of study] caught and studied Monday at the small vernal pool in Norfolk, said Dawn McKay, a herpetologist with the Department of Environmental Protection who is leading the sampling survey. Of the four deformed frogs in Norfolk, a Bullfrog had two extra hind legs, a Pickerel frog and a Green frog each had a missing front leg, and a Green frog was missing yellow pigment, so it appeared to be blue.

The unnamed wetland in Norfolk, a town in northwestern Connecticut that borders Massachusetts, is in an upland area surrounded by heavy woods. There are no nearby farms or industries.

"It's too early to say it's not widespread, but it doesn't appear to be in Connecticut," McKay said, cautioning that she has not completed a survey

Until last Monday, the sampling at nearly a dozen other locations had not revealed any significant problems, she said. A few more sites remain to be sampled. Biologists and zoologists in several states began looking for answers in the frog-deformity mystery in 1995, after children on a school outing in Minnesota caught many deformed frogs in a wetland. In Connecticut, scientists joined the hunt for clues after a young boy from Moosup caught frogs with missing legs at Porter Pond in August 1997. This year since July 1, almost weekly sampling surveys at the pond have shown that between 10 percent and 30 percent of frogs caught by volunteer teams had deformities. A sampling usually entails catching at least 50 frogs for observation. The nationwide search for answers is a loosely coordinated scientific effort.

Scientists at state and federal agencies, universities, conservation groups and even some individuals report their findings to the North American Reporting Centre for Amphibian Malformations. The U.S. Environmental Protection Agency and the U.S. Geological Survey maintain a Web site ([www.nprwc.usgs.gov/narcam/index.htm](http://www.nprwc.usgs.gov/narcam/index.htm)) as a clearinghouse for the information.



**A** university expert is worried about how frogs might be affected by atrazine in the Barossa Reservoir.

The Environmental Protection Authority (EPA) announced last week that low concentrations of the herbicide have been detected in the reservoir for the past year. Traces have also been found upstream in the South Para and Warren Reservoirs and in some creeks.

Water being drawn for human consumption is being treated to remove the traces of atrazine and campers have been warned not to drink water from creeks in the upper part of the catchment.

Associate Professor of Zoology at the University of Adelaide Mike Tyler says research in the United States and United Kingdom has proven that atrazine can kill or cause abnormalities in frogs. However, he says there has not been much study of frog populations in the Barossa area, so it may be difficult to tell if atrazine has had much of an affect.

"Frogs lay naked eggs in water and therefore they're exposed to any pollutant that's present in water," Professor Tyler said.

"They're very, very sensitive indicator organisms.

"It means you can therefore go to a place and start looking at the frogs and tadpoles, and say hey, there's something wrong with the environment," he said.

## TIME FOR FROGS:

**F**eel like croaking? You're not alone. The lowly frog is chirping its way into our pads in the form of Christmas ornaments and wine corks, CDs and sink stoppers. The latest amphibian landing: Discovery Channel's New World Frog Clock, a 13-inch blue wall model featuring frogs at every hour and a fly on the second hand. The charm, to some, is how the clock trills and ribbits its way through the hours courtesy of recordings of the Pacific Treefrog, Couch's Spadefoot Toad and other species: Five croaks for five o'clock. You get it. The clock debuted on the TV shopping network QVC earlier this month and 567 sold during one brief mention, according to a network spokeswoman.

70 species were auditioned for starring roles. "Not only are frogs great singers, they have a great story," says Manning. "They are in dreadful trouble around the world."

Frogs already were rising on the cultural radar screen, with Budweiser frog ads and a pet frog crisis on Fox TV's hip "Ally McBeal" show. Smithsonian Folkways reissued "Sounds of North American Frogs" as a CD this summer and the recording of 57 frog voices has gone off the charts at some college radio stations. Many of the frog sounds are mating calls. By Jura Koncius November 19, 1998.

**HERPDIGEST** is a free, electronically weekly collection of herpetological scientific and conservation news and articles from newspapers, the Internet, government & non-profit press releases.

With compliments Carl Spears

with compliments



# Despite enthusiasts,

Frogs are dying from pollution and disease, but the suburban backyard might be their salvation. **Sian Powell reports**

**F**ROGS are leaping into the national consciousness taking up residence in proliferating frog ponds in suburban gardens and, in some cities, outstripping birds in popularity.

Perhaps it's the recent news of the extinction of various high altitude species in far north Queensland that has prompted the surge of interest in frogs. Maybe it's a parochial thing — fed by the understanding that in some places frogs have been hounded into local extinction by a lethal combination of cane toads and pesticides.

People could be taking an interest because of the enormous publicity won by the game little colony of green and golden bell frogs in Homebush Bay, the only amphibians to hold up the Olympics juggernaut. Or it could be prompted by frog Web sites, which are some of the best on the Internet.

Probably, though, frog appeal springs from the realisation that if frogs are the pit canaries of the environment — the creatures whose vigour is an indicator of the health of the entire ecosystem — then their shrinking numbers are ominous indeed.

Whatever the reasons, frogs are moving

in on domestic gardens, encouraged by people sinking ponds, creating bog zones, and going easy on the pesticides.

One popular book, *Attracting Frogs To Your Garden*, caters for those Australian city-dwellers who are keen to hear frog calls on warm nights. It has sold 15,000 copies since it was first published two years ago. The author, Ken Casey, says building suburban frog ponds has become hugely popular, to the point where in some parts of Brisbane big networks of suburban frog ponds have actually prompted an increase in frog populations in the face of a general decline.

"People want to do something for the environment," Casey says, "and they want frogs to be around for their children and grandchildren to see." The metamorphosis of tadpoles into frogs is a huge attraction as well as a means of introducing children to the magic of nature.

Lothar Voigt, who is on the committee of the Frog and Tadpole Study Group of NSW, is astonished by the burst of interest. "It's grown phenomenally," he says, adding that Frog Week (which has

just passed) has gone from strength to strength since it was first launched in 1993, and most recently incorporated frog-mobiles (a couple of four-wheel drives) to catch the attention of the public.

Voigt lives in frog paradise in Sydney's Rose Bay, smack in the middle of double-fronted brick suburbia. In his front garden is a tadpole factory — a couple of dozen polystyrene Eskies filled with tadpoles of varying species in varying stages of development. The water is aerated with an ingenious system of hoses, and he will provide tadpoles to those enthusiasts who have dug a pond in their gardens and waited in vain for frogs to arrive.

Large frog ponds dominate his back garden, where a big colony of frogs lives in moist luxury. Voigt is surprised that he has never had a complaint about the noise — all the frogs croak loudly and joyfully at the first taste of rain.

Still, perhaps it's not so surprising. Enthusiasm for frogs flourishes over much of Australia. There are now eight frog societies in Brisbane, and the biggest group has more than 6000 members, Voigt

## it's still a frog's life

The Australian 27-11-98

says. "There are far more organised frog keepers in Brisbane than there are organised bird keepers."

This could be partly because cane toad incursions have been particularly damaging to frog colonies in Queensland, and partly because laws there regarding frogs are a bit more flexible. Until last year in NSW, Voigt explains, it was illegal to even pick up a frog in the wild (anywhere, not only in national parks) to identify it, let alone take it home. This restriction, which stymied attempts to conduct frog surveys, was relaxed after pressure from frog experts.

Casey says that in Brisbane, the tusked frog, which has little walrus-like projections sticking out of its mouth, was never actually rare, but it is far more common than it once was, thanks to the backyard frog pond. The green tree frog, certainly in some parts of Brisbane, is climbing back up the ladder of viability and building healthy populations, taking advantage of wildlife corridors and the spreading network of ponds.

Although city-dwellers can't really do much to arrest the decline of many threatened species, frog-lovers hope the burgeoning interest in backyard frogs will motivate people to agitate on behalf of more remote species.



Frog man: Lothar Voigt in his backyard

Between one-quarter and one-third of the 210 frog species in Australia are in decline. All species, from the 11cm white-lipped tree frog to the 1.5cm pygmy rocket frog, have felt the pressure of encroaching humans.

In NSW alone, the Frog and Tadpole

Study Group has identified 26 species that are in trouble, and three species are known to be extinct. It's even worse in Queensland, where possibly seven species have become extinct in recent times.

Much of this carnage is the result of habitat destruction, the introduction of chemicals, and the onslaught of cane toads. The spreading plague minnow, a feral foreign species, has also made inroads — eating tadpoles wherever it finds them. This minnow was introduced to eat mosquito larvae, and even as recently as five years ago farmers were being advised to stock waterways with them.

Ultraviolet radiation, resulting from the depletion of the earth's atmosphere, has also taken its toll. Frogs have very thin, permeable skins which are easily damaged by the sun.

In recent years, a fungal disease has added to frogs' woes and it might even be responsible for the disappearance of three frog species in northern Queensland. The chytridiomycete fungus probably suffocates the skin-breathing amphibians by coating their undersides and legs, and scientists fear its spread could have far-reaching implications.

The picture is bleak, but frogs have wonderful recuperative powers, Voigt says. They can be explosive breeders, when the conditions are right, and if Australians continue to take an interest in their wellbeing, the decline of many species might even be arrested.



**Where do frogs breed?**

Frogs are found in a wide range of habitats but, like other amphibians, they must breed in water, such as garden and farm ponds, lakes and marshes. Female frogs

may lay their eggs in ephemeral ponds – ones that dry up in summer – which tend to be shallow and so warm up fast in spring, helping tadpoles to develop more quickly. Another advantage of ephemeral ponds is a dearth of predators, especially fish, which normally prey on frogspawn and tadpoles. But the danger is that the tadpoles may not metamorphose into froglets before the pond dries out.

**Why do frogs produce so much spawn?**

It's a common misconception that frogs produce 'too much spawn'. It might stem from the appearance of spawn, the 'jelly' part of which – after being expelled from the female – absorbs water and swells up to many times its original size. Most female frogs lay their clumps within a few days of each other, and so quite a sizeable 'ratt' of spawn can be produced. But frogs only produce enough eggs to ensure that, given all the hazards they face in life, they still manage to replicate themselves.

**How long do frogs live?**

There is no simple answer. Calculating an 'average' frog life expectancy would probably give only a few months, but this is very misleading. The vast majority of eggs laid in a spawn clump will never make it to adulthood. Some embryos die before hatching, due to frost, fungal infection or predation. The tadpoles that make it out of the spawn mass must then endure several weeks of dodging a horde of enemies. (Unlike toad tadpoles, which have unpleasant chemicals in their skins to deter would-be predators, frog tadpoles are wholesome and represent easy pickings.) Only a few per cent of these will survive to June, when they begin to emerge from the pond as juvenile frogs.

Once on land, the tiny froglets face a whole new set of predators, and they have two or three years of terrestrial life to survive before returning to the pond to breed. So, the next time you see a mass of spawn, with its tiny black dots representing hundreds of potential frogs, remember that, typically, only five at most will return to breed. Frogs that reach six years old deserve a medal: it's likely that fewer than one in 10,000 would reach such an age.

Asked to name the garden animal they treasure most, many people put the common frog at the top of their list. It's not difficult to see why. Few other animals feature so dramatically in our lives. As spring arrives, groups of 40 or more common frogs may descend on a garden pond in a flurry of hops and splashes, producing a breeding event that must rank as one of Britain's most engrossing, and accessible, wildlife spectacles.

But though most people know that frogs lay jelly-like clumps of spawn, are adept at leaping and will dispatch garden slugs, they will struggle for explanations when it comes to questions such as how long frogs live or why some frogs spend the winter in the pond, even though it could freeze over. The answers offer a fascinating insight into a life form very different to our own.



with compliments Alex Clouston

**Thank You  
to all those  
who contributed to  
this newsletter**

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Carl Spears	Editorial Panel	(02) 9247 3953 (w)	
Vacant	Editorial Panel		

We hold six informative, informal, topical and practical meetings each year at the Australian Museum (William Street entrance) in Sydney. Meetings are held on the first Friday of every even month (February, April, June, August, Oct. and Dec.) at 7 pm for a 7:30 pm start. Visitors are welcome. We are actively involved in monitoring frog populations and in other frog studies, and we produce the newsletter *FROGCALL* and *FROGFACTS* information sheets. All expressions of opinion and information are published on the basis that they are not to be regarded as an official opinion of the Frog and Tadpole Study Group Committee unless expressly so stated.