



**PARENTAL CARE
AMONG ANURANS AND URODELES**

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OBJECTIVE:

Introduce the various methods that Amphibians have adapted to provide parental care and the costs/benefits associated with these adaptations.

*All information comes from Wells (2010) unless otherwise noted

LECTURE OVERVIEW:

- A. What is parental care?
- B. Parental care in Anurans
- C. Parental Care in Urodeles
- D. Parental Care in Caecilians
- E. Costs associated with parental care
- F. Benefits associated with parental care
- G. Future direction for research or conservation

PARENTAL CARE: SUMMARY

- refers to any type of parental investment in offspring after eggs are laid or the young are born.
- Does not include the initial energy investment of producing gametes
- increases the survivorship of the young.

SUMMARY CONT.

- some costs to the care giving parent
- has been reported in most of the major amphibian families.
- It is thought to have evolved as a response to the dangers of physical or biological threats to the survival of the species.

ANURANS

- Occurs in an estimated 10-15%
- Crump(as seen in Wells, 2010) reported it to occur in 6%
- Figures are believed to be underestimated

ATTENDANCE OF EGGS

- Most common form among Anurans
- Occurs in 13-15 families
- Both males and females can be the care giver
 - over 60% of species have male attendance



	Sex			Total
	Male	Female	unknown	
Egg mass attended by <i>M. bifasciatus</i>	2	7	6	15
Egg mass attended by <i>M. punctatus</i>	5	5	11	21
Egg mass unattended	-	-	-	13
Total (both species)	7	12	17	49

Some species exhibit amphisexual attendance- Either the male or female, but not both, are the primary caregiver (Lehtinen, 2003).

(Amphisexual egg attendance among *Manitacorypha*: Lehtinen, 2003)

TRANSPORT OF EGGS

- Transport of eggs have evolved in four distantly related families:
 1. Discoglossidae
 2. Pipidae
 3. Myobatrachidae
 4. Hemiphractinae



Pipa pipa



Myobatrachidae



Alytes obstetricans

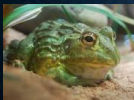
All four species within the Discoglossidae exhibit males as the egg transporter; all others the female transports the eggs.



Horned Marsh Frog, Hemiphractinae

ATTENDANCE OF TADPOLES

- Most adult frogs are terrestrial, therefore very few species attend aquatic tadpoles.
- The ones who do, however, display a wide range of behavior.



African Bull Frog

Aggression:
[Aggression display](#)

Assurance of tadpole safety
[Frog saves tadpoles - YouTube](#)

TRANSPORT OF TADPOLES

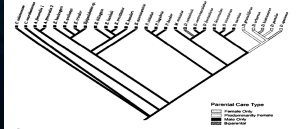
- Usually in association with attendance to tadpoles
- Has been observed in both male and females of various species
- Some tadpoles are transported to water while others show complete development on parents back
- Species carry a range of tadpoles at any given time, ranging from 1-40



FEEDING OF TADPOLES

- Always associated with oviposition site with limited resources
- Observed in several species of Dendrobatids
- Males only
- Females only
- Biparental

(Male transportation appears to be the ancestral trait with



• [Poison arrow frog](#)

* Eggs can be fertilized or unfertilized

ONE UNIQUE FROG!

- *Rhinoderma darwinii* seems to show characteristics of several forms of parental care.



[Aliens!](#)


[Tadpole movement](#)

ATTENDANCE OF FROGLETS

- Froglets have been reported to remain with a parent for 30-40 days in *Cophixalus pakari*.

TRANSPORT OF FROGLETS

- Fairly recent discovery
- Associated with frogs that undergo direct development
- The main function appears to be dispersal of juveniles into suitable habitat.
- Have been known to carry up to 50m.

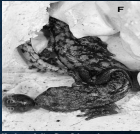


Picture by David Rickford.

PARENTAL CARE OF URODELES

- Considered less complex when compared to Anurans
- Consists entirely of egg attendance and larvae
 - Or does it?

	First week	Second week	Third week	Fourth week	Fifth week	Sixth week	Total
Complete contacts by first hatching	2 (878 ± 500)	0	0	0	2 (79 ± 28)	2 (529 ± 21)	6 (1,486)
Complete contacts by second hatching	2 (875 ± 110)	2 (571 ± 318)	2 (64 ± 39)	3 (55 ± 15)	4 (50 ± 9)	-	13 (1,215)
Nest site desertions by female	2 (50 ± 55)	2 (140 ± 55)	2 (110 ± 64)	3 (150 ± 43)	2 (305 ± 240)	12 (319 ± 210)	23 (1,074)




Northwest Italian Cave Salamander

Study performed by Osto, Ottensllo, Pastorino, and Salvadio (2010) shows possible hatching transport.

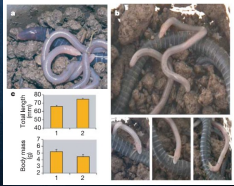
PARENTAL CARE OF CAECILIANS

- Poorly understood
- More than half are viviparous
- Many oviparous believed to show attendance to eggs

Wells, 2010





Skin feeding in *Boulengerula taitanus*



Kupfer et al. (2006)


COSTS

- Physical risk to the parent
 - Injury
 - Death
- Energetic costs
 - Reduction of body mass
 - Kipfer et al (2006) showed a 14% reduction
 - Reduction of stored energy reserves
- Reproductive costs

BENEFITS

Clearly enhances the survival of offspring! (Wells, 2010)



Marble Salamander

Treatment group	# Nests	% Nest success (mean ± 1 se)	SVL (mm) (mean ± 1 se)
Female abandoned (E)	9	9.7 ± 6.3	58.3 ± 2.8
Female abandoned (U)	12	7.4 ± 5.6	57.2 ± 1.1
Female removed (E)	8	8.9 ± 7.9	59.4 ± 1.5
Female removed (U)	14	8.0 ± 5.8	57.9 ± 0.6
Female present (E)	14	26.1 ± 7.9	57.5 ± 1.1
Female present (U)	15	14.3 ± 4.9	58.8 ± 1.2

Croshaw & Scott, 2005

BENEFITS

- Protection against conspecifics
- Protection against heterospecific predators
- Protection against desiccation
- Protection against fungus and pathogens
- Aeration and agitation of eggs

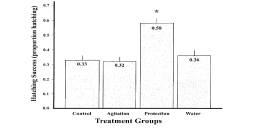


FIG. 2.—Mean ± 1 SE propagated hatching success for the control (solid experiment) (E), the unenclosed (U) and the agitated (A) treatments. The asterisk (*) indicates a significant difference from the control (solid experiment) (E).

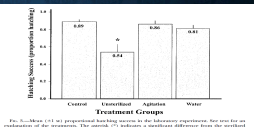


FIG. 3.—Mean ± 1 SE propagated hatching success for the desiccation experiment. The asterisk (*) indicates a significant difference from the control (solid experiment) (E).

Croshaw & Scott (2005)

ECOLOGY AND EVOLUTION

- Believed to have emerged in response to the tendency toward terrestrial modes of reproduction
- Aquatic environment dangers favored eggs being laid away from water
- New set of problems led to evolution of parental care
 - Dissection

WHERE DO WE GO FROM HERE?

- Sex roles
 - Internal fertilization- tends toward female care
 - External fertilization- tend toward male care
- Caecilians are poorly understood
- Costs/Benefits coupled with reproductive costs would give a more detailed insight into relationships between reproductive modes, parental behavior, and mating systems

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