Predation

How amphibians and reptiles get food and how they avoid being eaten.

I. General

Feeding habits:

stenophagic - narrow feeding habits (e.g., some blind snakes only eat termites).

uryphagic - wide feeding habits (eat wide range of stuff)

Feeding behavior:

sit and wait:

Move little or not at all, and wait for prey to come along (or somewhere close by).

Classic example might be alligator snapping turtles

active foraging:

Spending time actively looking for prey.

Many lizards, and pretty much any herbivorous species (though we don't think of “plants” as prey).

Many can, of course, switch between foraging modes. This can depend on such factors as:

Prey availability, hunger, experience, age, etc. (see table 10.2 in text).

Food chain:

Most amphibians and reptiles are somewhere in the middle of the food chain. There are obvious exceptions:

crocodiles, Komodo dragons, larger boas and pythons.

Effects of age:

Also, as expected, predation is thought to be higher in juveniles (though because of the secretive nature of juveniles, this has been difficult to confirm).

II. Prey detection:

Before prey can be captured, it must be found. Amphibians and reptiles have several ways to do this (most of these should be fairly obvious):

sight

chemosensory (often using Jacobsen's organ)

auditory (not well documented).

thermal (e.g., think of pit vipers, boas, etc.).

tactile

III. Getting food (capturing prey):

Amphibians:

Salamanders: all are carnivorous, most want live prey.

Most go after small invertebrates: earthworms, insects, spiders, etc.

Some will eat larval stages of other salamanders.

Larger ones may go after fish, crayfish, etc.

Hellbenders use “gape and suck” method of capturing prey.

Some frogs and salamanders have a projectile tongue they can use to help capture prey.

Anurans: again, carnivorous (as adults).

Tadpoles may be herbivorous or even filter feeders.

Caecilians: thought to be mostly carnivorous, but not well studied (we made mention of this earlier)

Terrestrial forms go after earthworms or even small burrowing vertebrates.

Aquatic forms go after fish/fish eggs (and may use “gape and suck” method).

Reptiles:

Tuataras: carnivorous.

Basically anything they can catch:

earthworms, slugs, insects, rodents, lizards, young shearwaters (they share/appropriate burrows with/from shearwaters).

Generally grab prey, chew it to a pulp, and swallow.

Lizards: mostly carnivorous; a few omnivorous, and a very few even herbivorous.

Marine iguana and chuckwalla are herbivorous examples

Again, lizards will go for pretty much anything they can catch:

Invertebrates up to large mammals and anything in between.

Chameleons have projectile tongues - already discussed.

Turtles: most are omnivorous and will eat anything they can.

Some examples:

Snappers - mostly carnivorous, but captives have been known to eat carrots.

Alligator snapping turtles -use lure in mouth to attract fish. Then use combination of suction and snapping jaw to capture/kill fish.

Green sea turtle - grazes on sea grass as an adult

Many tortoises - herbivorous, but will eat carrion and chew on bones for calcium.

Emydids - often carnivorous when young, then switch to herbivory when older.

Leatherback - jellyfish specialist

Hawksbill - sponge specialist.

Crocodiles: eat pollen and flowers.

Seriously - eat anything they can swallow (including humans!)

Prey is usually grabbed, dragged under and drowned.

As prey decomposes, crocs will tear off pieces and swallow them.

Gizzard (with rocks) helps in digestion.

Gavials generally prefer fish, the rest eat anything they can get.

Some will use their hard palate to smash the shells of turtles.

Snakes: all carnivorous:

Four main methods of subduing prey:

1) grab and swallow

2) pin against ground and hold

3) constriction

4) venom

Some snakes are specialists:

Lycophidion (wolf snakes) have hinged (?), canine like teeth for dealing with skinks.

(grabs, then kills by constriction)

Dipsas (Colubrids) - eat mostly snails and slugs:

Have longer lower jaw used to hook into snail and pull it out of the shell.

The first two methods are fairly straight forward, but let's spend some time talking about constriction and venom.

Constriction:

Snake grabs prey, then quickly throws coils around prey.

Snake then exerts pressure. Until recently, this was thought to prevent the prey from breathing (expanding chest cavity), so prey was suffocated.

Recent studies have shown that the pressure is strong enough to stop the heart (pressure in chest cavity climbs to the point that the heart can't push blood into body - results in cardiac arrest).

This is still being studied.

Venom:

Venom first evolved as a method for food capture.

Obviously it's also good for defense!

Sometimes this can be spectacular, as in the case of spitting cobras.

The snake will “bite” the prey and inject venom.

Venom kills the prey, snake then eats the prey.

Two broad categories of venoms:

hemotoxic - attack circulatory system

neurotoxic - attack nervous system

More details on snake venoms:

But these can be subdivided (the following is derived from “Snakes in question”, Zug and Ernst, 2004 (2nd ed.)). Note that this list can be broken down several different ways (see for example Wikipedia, or your textbook (table 10.3)).

Proteolysins - cause cells and tissue disintegration, pain, swelling.

Cardiotoxins - can change heart contractions, depolarize cardiac muscle

Hemorrhagins - destroys walls of capillaries; causes bleeding.

Compounds preventing coagulation - do exactly that.

Thromboses - opposite - cause blood clots to form.

Hemolysins - destroy red blood cells

Cytolysins - destroy white blood cells

Neurotoxins - stop muscle function by blocking nerve impulses leading to muscle (particularly to muscles used in breathing).

(interfere with neurotransmitters).

As a general rule, elapids use neurotoxic venom and viperids use hemotoxic venom. There are exceptions:

Mojave rattlesnake (*Crotalus scultulatus*): some populations have mostly neurotoxic venom.

Spitting cobra (*Naja nigricollis*): mostly hemotoxic venom.

Note: the picture comes from a web page forum where people are discussing their “pet” spitting cobras (it appears to be someone's “pet”).

This is real stupidity - no should (outside zoos and research institutions) should keep venomous snakes!!!

Lots (LOTS!) of records of people keeping venomous snakes illegally winding up in hospitals or dead.

(To say nothing of threats to other people if these "pets" get out).

Many snakes have a mix of neurotoxic and hemotoxic components, but will lean towards one or the other.

Toxicity of venom is often measured using something called the LD_{50}. That's the lethal dose needed to kill 50% of the animals under study (e.g. mice).

Go through chart.

http://www.seanthomas.net/oldsite/ld50tot.html

http://en.wikipedia.org/wiki/Venomous_snake#Examples_of_LD50_toxicity_rankings

Obviously, overall toxicity is a combination of ld_{50} and venom yield (it does a snake no good to have very toxic venom if it can't inject enough of it).

Snakes can control how much venom they inject. Occasionally when defending themselves they will "dry bite". Bite but not inject any venom (lucky for the victim!).

Two more comments on snakes:

Some venomous snakes will also use constriction.

Prey capture is diverse (e.g., some snakes use their tails as a lure).

IV. Avoiding predation (getting eaten):

Many mechanisms aren't really specific to taxonomic groups so we'll go in a somewhat different order and discuss different strategies to avoid being someone meal.

(Fig. 11.3 is a nice summary of some of this, though possibly a bit simplistic)

Camouflage

Blending into the background, keeping still.

Numerous examples in your text

Stripes in snakes (snake appears to be still, but is actually moving).

Informing predator that it has been seen (this may discourage predator).

Some lizards will wave forelimb, possible to signal the predator that it can run away.

Warning colorations (sometimes combined with posture changes):

Obvious example are poison arrow frogs.

But many other species have bright colors to warn predators of toxins and/or bad taste.

Sometimes colors are not visible until animal changes posture

Salamanders and frogs with bright belly that is not shown until predator gets closer.

Try to avoid detection first, then warn predator if that didn't work.

Warning coloration has led to considerable mimicry:

The typical example is the coral snake - scarlet kingsnake relationship

But many other example can be found.

Sometimes they may even mimic millipedes or other animals if the animal being mimicked is poisonous.

Batesian mimicry - mimic is harmless

Muellerian mimicry - both species are poisonous/dangerous.

Running away

One of the obvious things to do. Some examples:

Lizards will move away from potential danger (may even continue to forage as they do this).

Frogs will jump into the water, then suddenly reverse direction and sit very still.

Sometimes will also burrow themselves in mud.

Flying frogs, lizards, snakes, can all escape by gliding.

Threat displays

Text (for some strange reason) lumps this in with running away.

Loud vocalizations that can startle predator.

Rattlesnakes - obvious

Hood in cobras

Open mouth displays

Structure

Skin may have spines, provide good armor, etc.

Obvious example again is turtles.

But other examples are also fairly well known:

Horns/spines in horned lizards

Scales in skinks.

Girdled lizards that roll into circle.

Chemicals

Already alluded to this above under warning coloration.

Many amphibians are very toxic.

FYI - you should wash your hands after handling amphibians!

Some (e.g. fire salamander) can squirt poisons at predator.

Snake venom

Bad smells (stinkpots, etc.)

Blood squirting by *Phrynosoma*

Feigning death

Hognosed snakes will put on quite a display, then turn upside down and lie still.

(If you turn them over, they "come back to life")

Tail autotomy

Loosing tail - done by many species, but particularly lizards.

Tail will often "squirm" quite violently to detract predator.