Discovering Dragonflies

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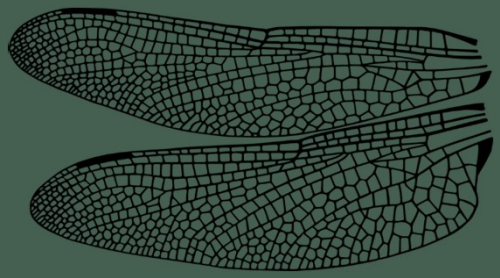
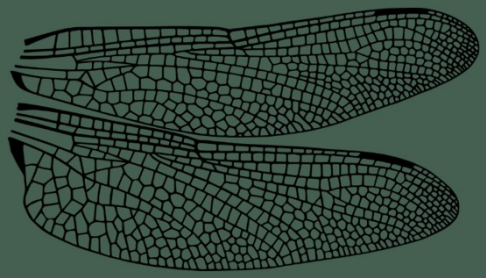
Discovery Center – Manitowish Waters, Vilas County

- Educational programs for all groups and ages
- Citizen science
- Water program
- Grounds and trails
- Funded by members, donations, grants
- www.DiscoveryCenter.net



Outline



- Evolution and history
- Eggs
- Nymphs
- Adults
- Identification

But first – let's test your knowledge!

What is the fastest recorded speed for a dragonfly?

a. 30 mph

b. 40 mph

c. 50 mph

d. 60 mph

Southern Giant Darner

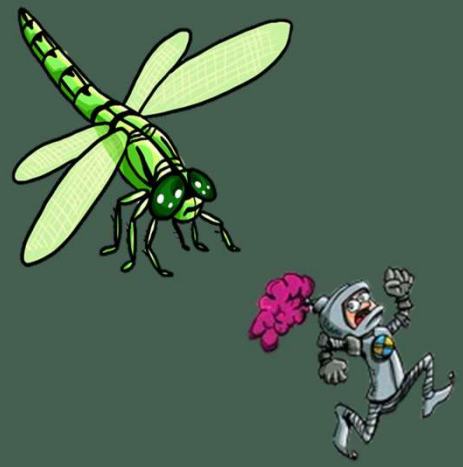
How many species of dragonflies are found in Wisconsin?

a. ~85
b. ~110
c. ~190
d. ~240

How many species of dragonflies are there in the world?

a. 1,000
b. 3,000
c. 5,000
d. 7,000

What insects do knights fear the most?

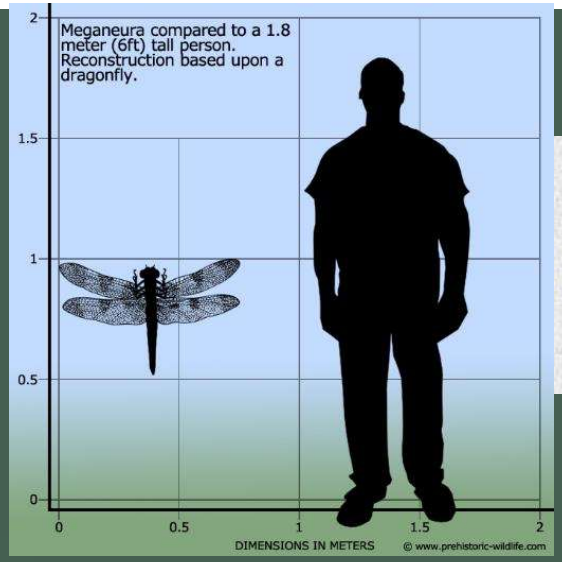


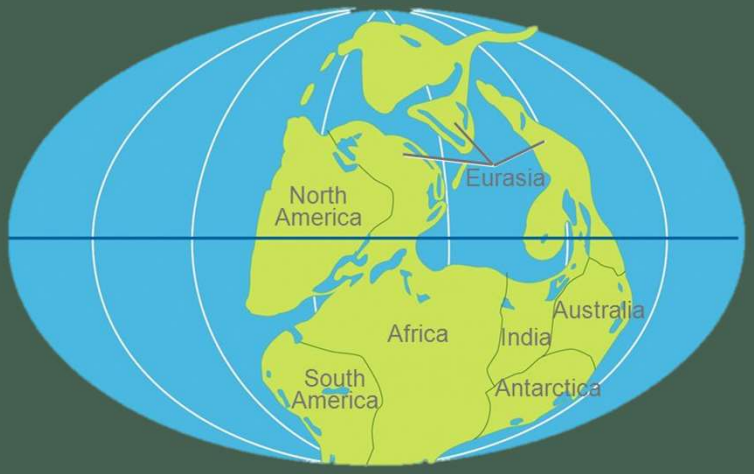
Taxonomy

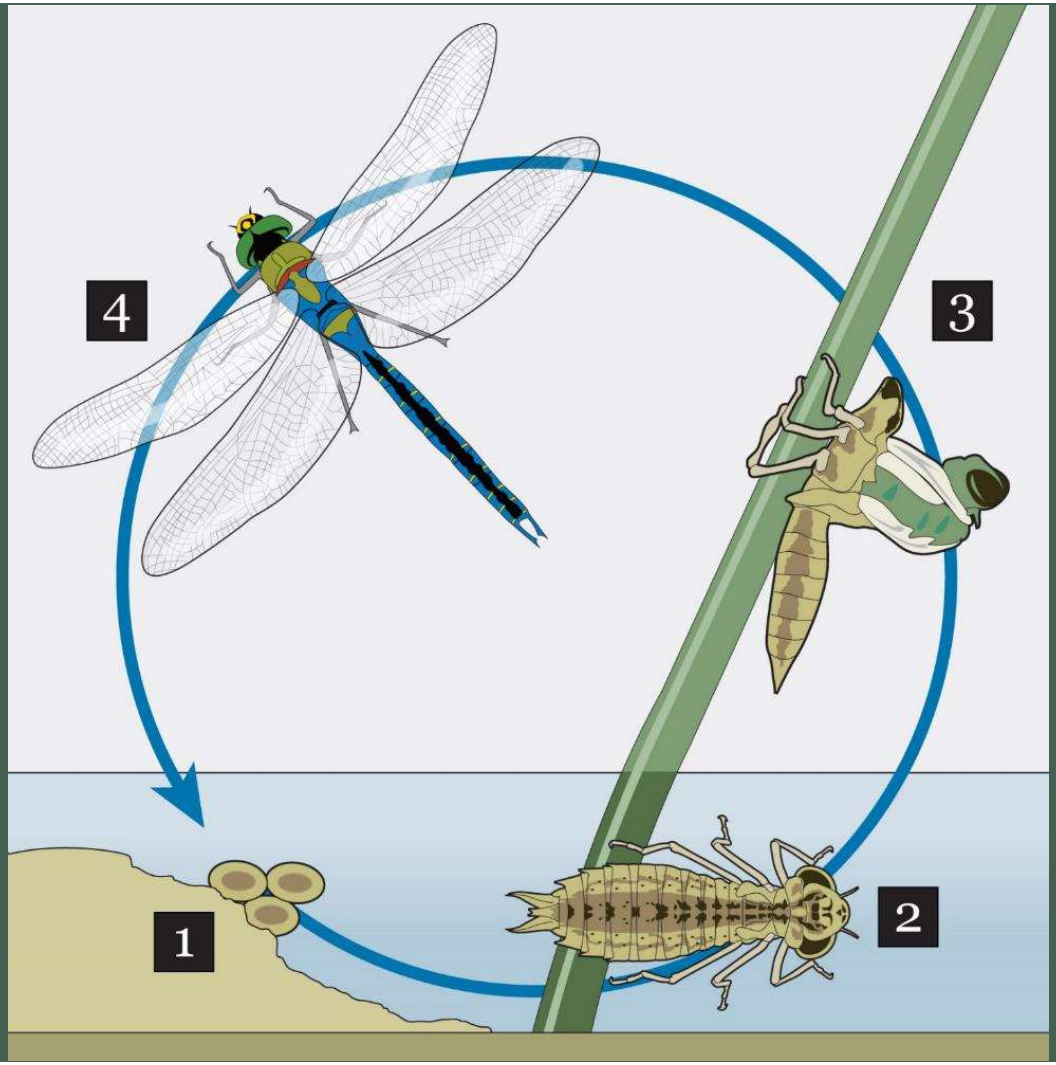
- Kingdom: Animalia
- Phylum: Arthropod (insects, spiders, crustaceans, etc)
- Class: Insect
- Order: Odanata (dragonflies and damselflies)
  - From Greek "*odontos*" meaning "tooth"
- Suborder: Anisoptera (dragonfly)

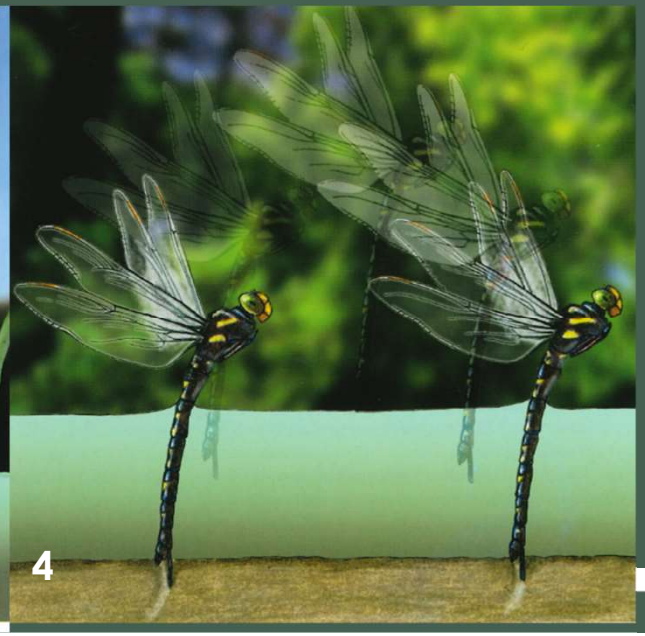
Evolution

- Dragonflies appeared in the fossil record ~350 million years ago
- Dinosaurs ~230 million years ago
- Earliest dragonflies had a wingspan up to 3 feet!






4
3
1
2



Egg Laying Strategies

1. Scattering
2. Sticky string attached to plant matter
3. Insertion into plant stem
4. Insertion into sediment

Egg laying

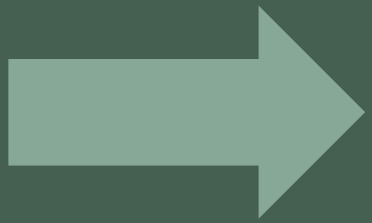
Egg laying video play by play

Egg parasite – the water mite

- Usually attach to nymphs and adults
- Deadly in large numbers
- Usually harmless if single

Egg Hatching

Nymphs- “aquatic larva”



Nymphs- “aquatic larva”

- About 90% of dragonfly life is spent as a nymph underwater
- Nymph stage can last several months up to several years
- Up to 15 molts before adulthood
- Pull water in through rectum to breathe – can also use this to jet propel

Nymphs- “aquatic larva”

- Voracious predators- will eat anything that moves!
- Mouth parts (labium) can extend up to a third of the length of their body
- Variable strategies: Stalk, sit and wait, burrowing
- Also a food source to fish, birds, other insects, and other nymphs






Nymph eating video play by play

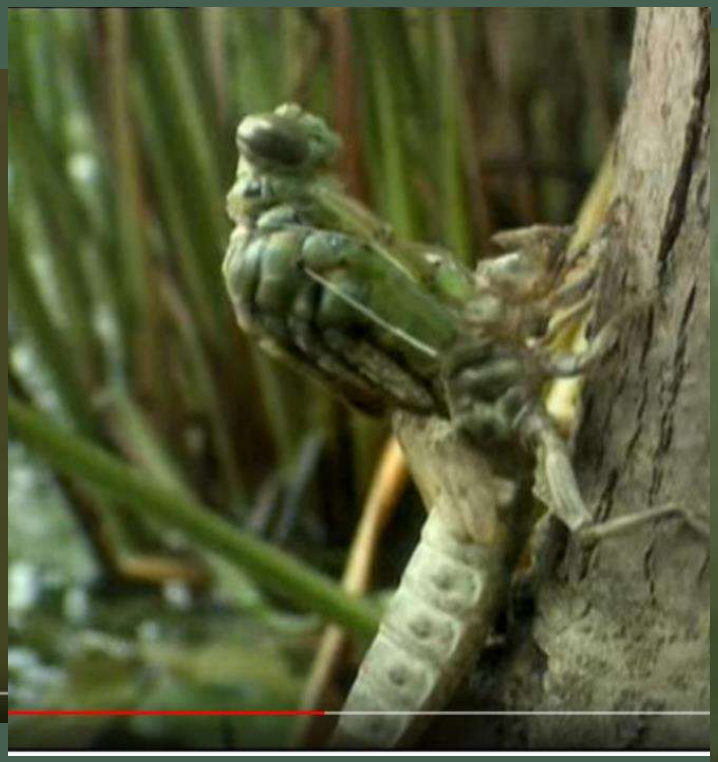
Nymphs- Emergence

- Final molt on land
- Most emergence takes place over night
- Head to back emerge, then rest while legs harden before full emergence
- Wings unfurl, fill with liquid, then dry out
- Up to 90% mortality while emerging (no defenses)
- Process takes 45 min to an hour

Purple martin

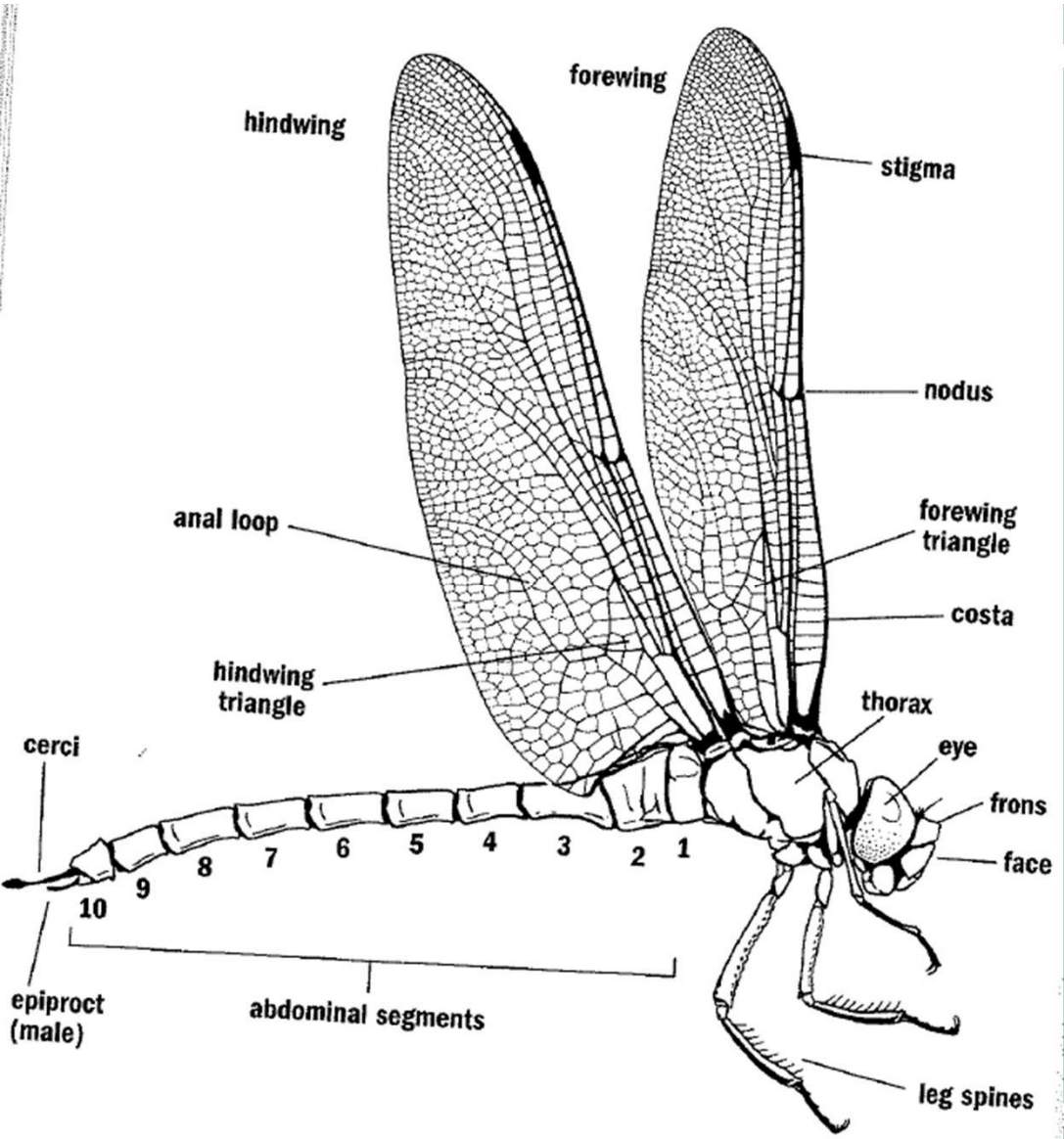
Cedar wax wing

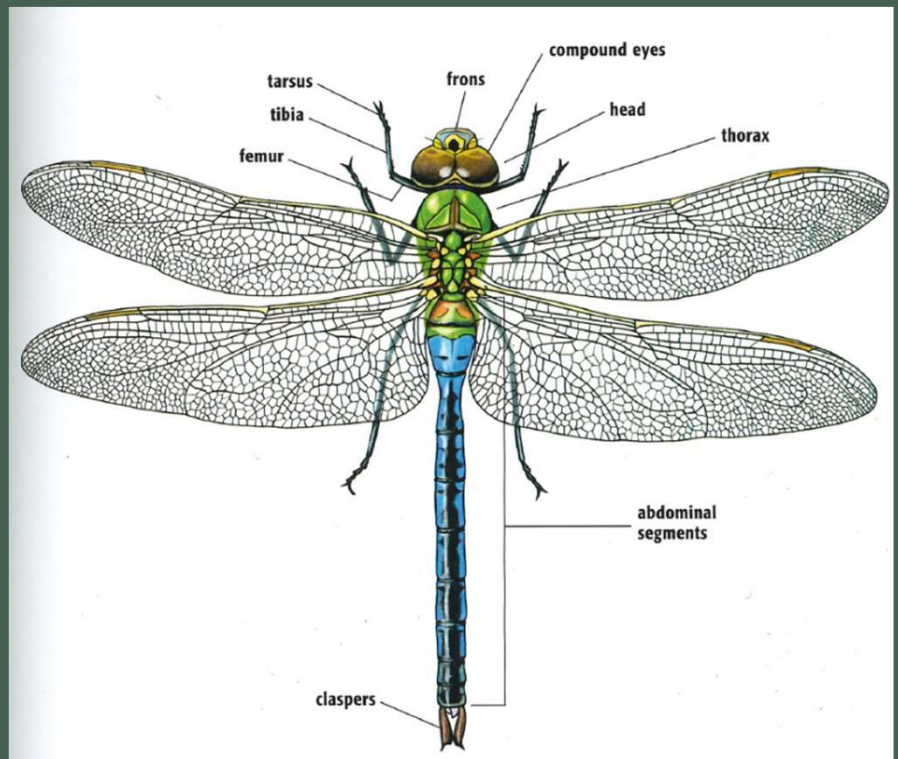
Eastern phoebe



Emerging play by play

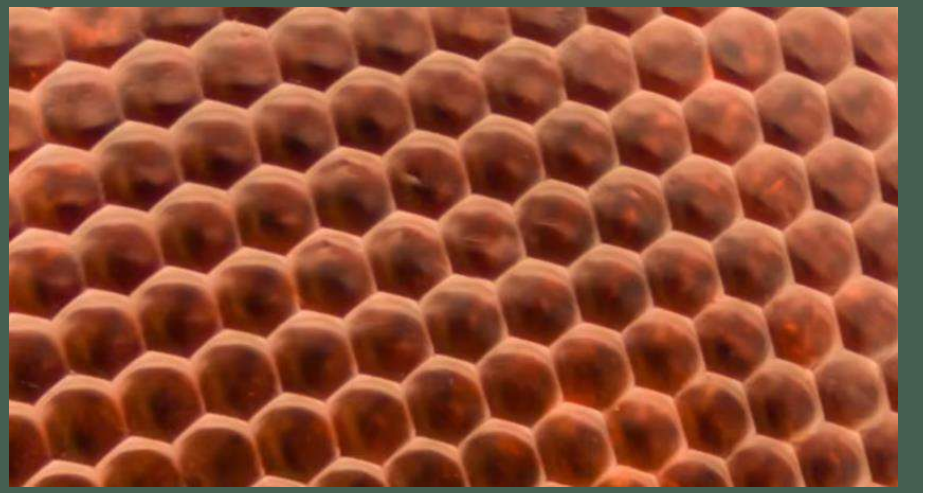
Emerging play by play


hindwing
forewing
stigma
nodus
anal loop
forewing triangle
costa
hindwing triangle
thorax
eye
frons
face
cerci
1
2
3
4
5
6
7
8
9
10
epiproct (male)
abdominal segments
leg spines

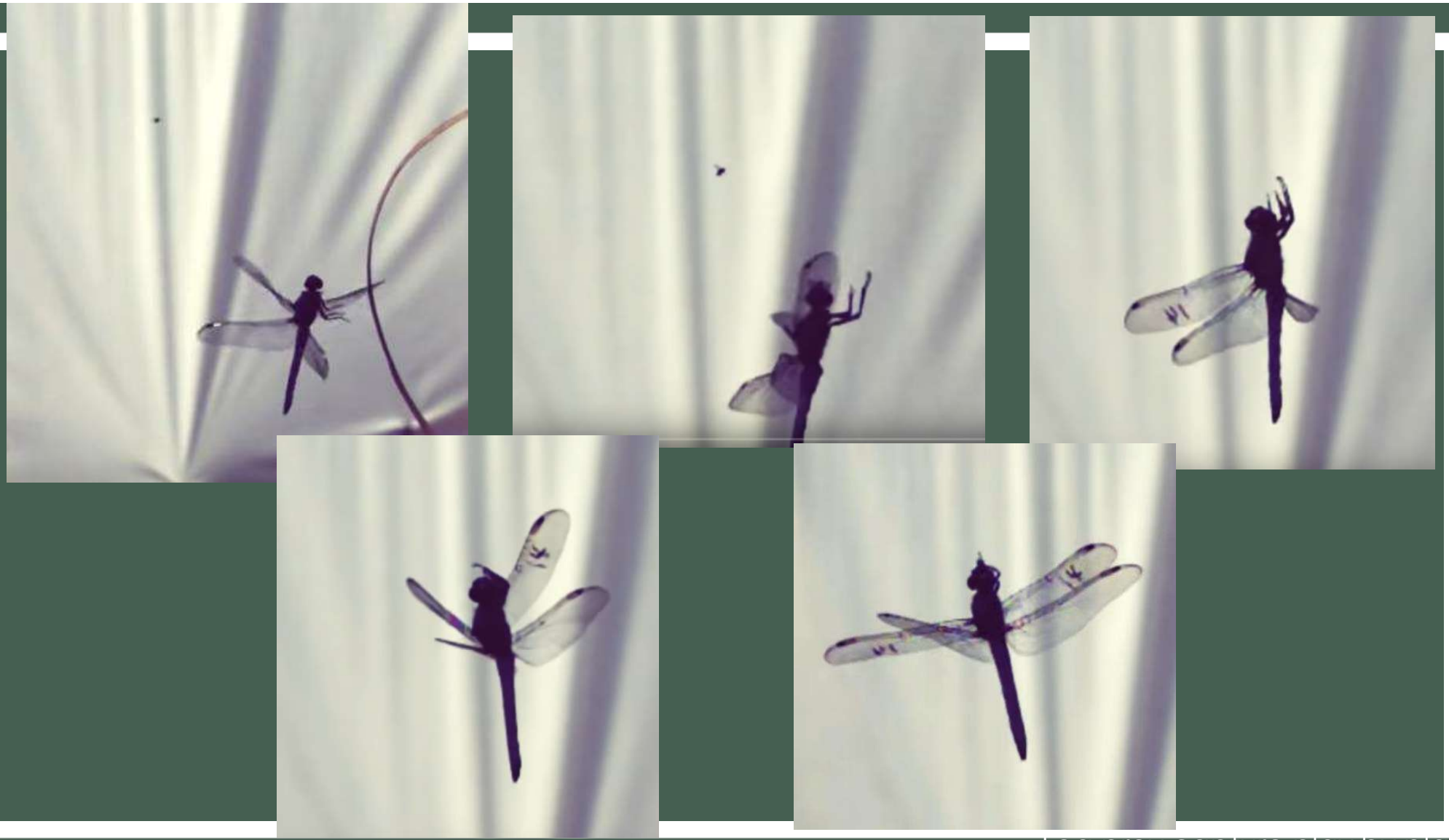

compound eyes
tarsus
frons
tibia
head
femur
thorax
abdominal segments
claspers

Adults – Eyesight

- Can see almost 360 degrees – large eyes + swivel head
- 30,000 eye lenses: Can see ultraviolet light and polarized light
- UV patterning on bodies could be method of communication
- Vision can discern individual wing beats to gauge speed
- Visual hunters – cannot hear, smell, or vocalize



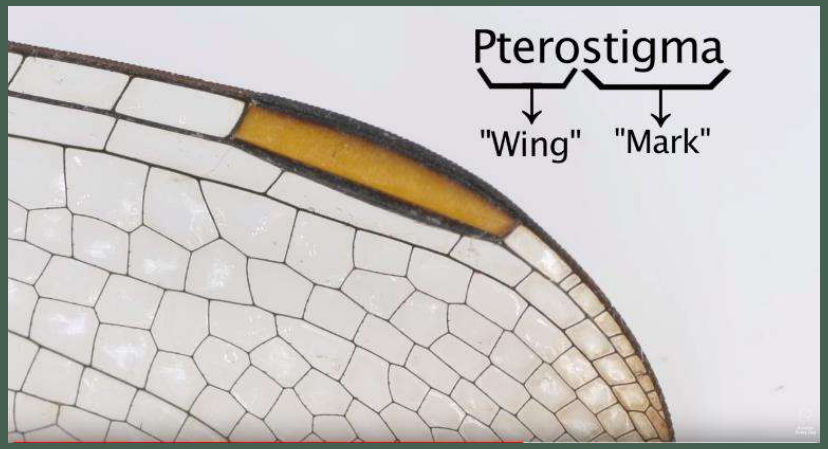
Leg prey capture
(only 7 seconds)



Leg prey capture play by play

Adults- Wings

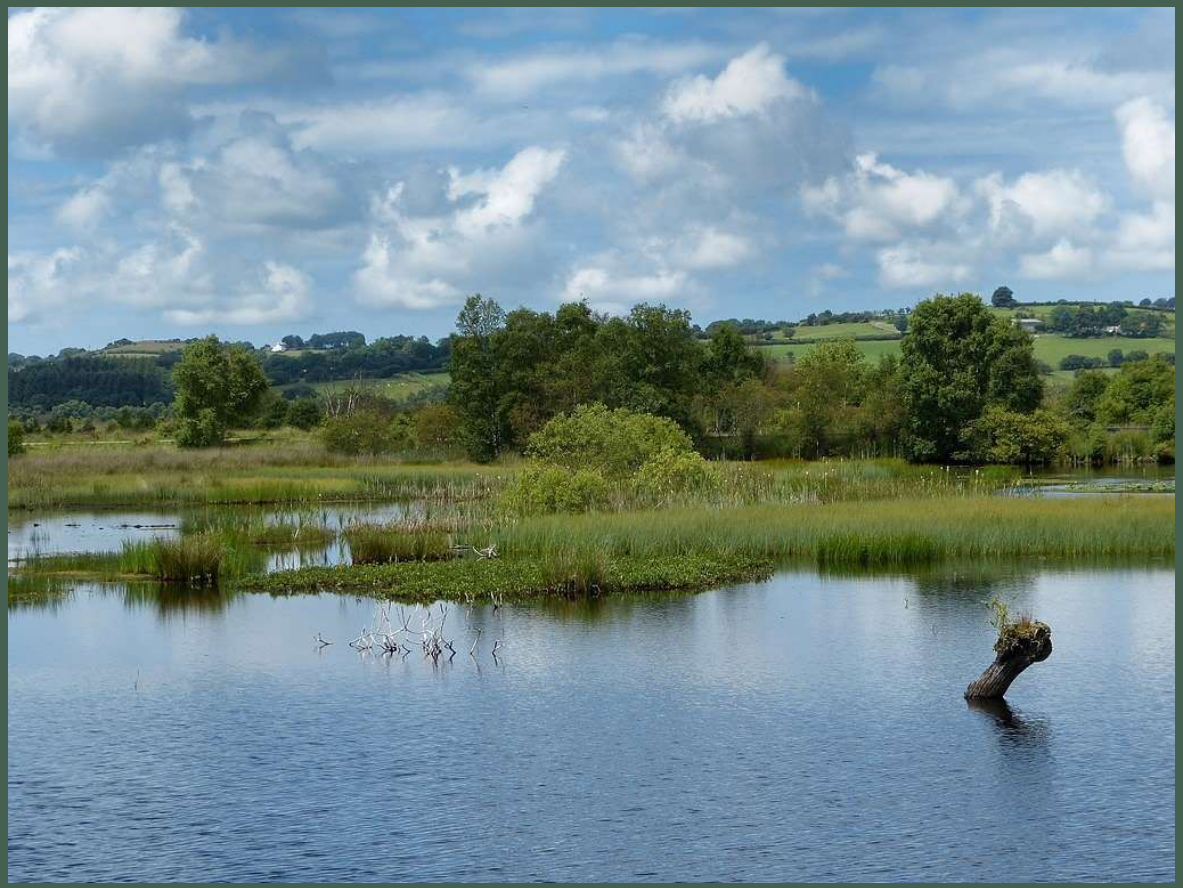
- Wings attached directly to muscles in thorax
- Each wing can move individually
- Excellent flyers – can fly forwards, backwards, side to side, up, down, hover
- Venation for structure and support
- Pterostigma: Heavier than rest of wing – complex aerodynamics – helps them to glide and fly faster
- Studied extensively for aerodynamics



Wing muscles

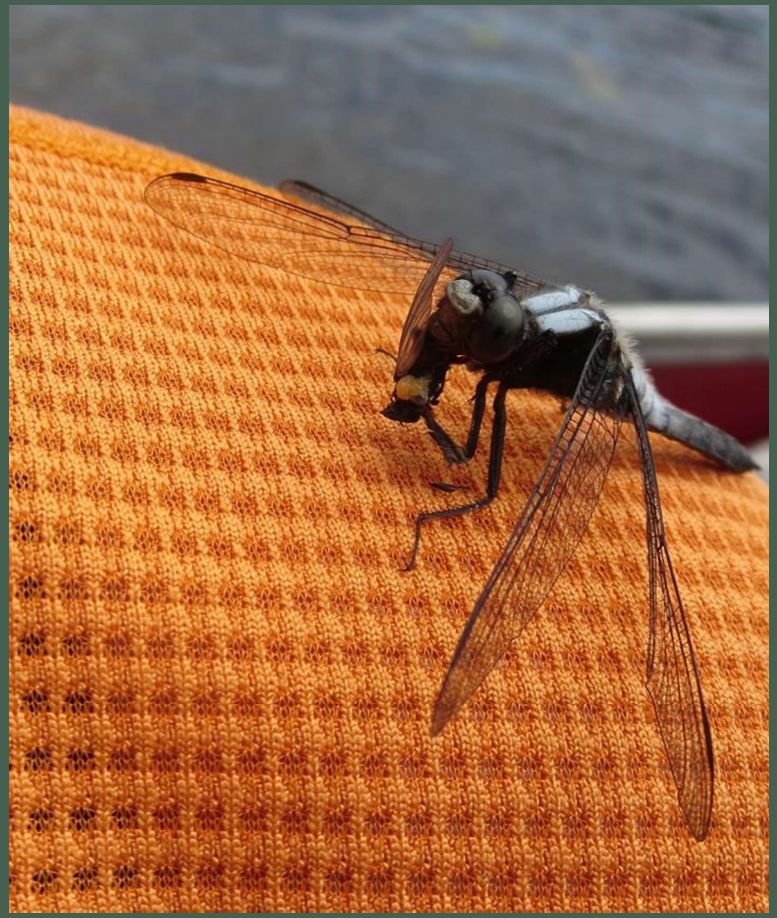
Adults- Habitat

- "Habitat" = larval stage and breeding areas
- Depends on the species!
- **All dragonflies – natural shorelines**



Adults - Diet

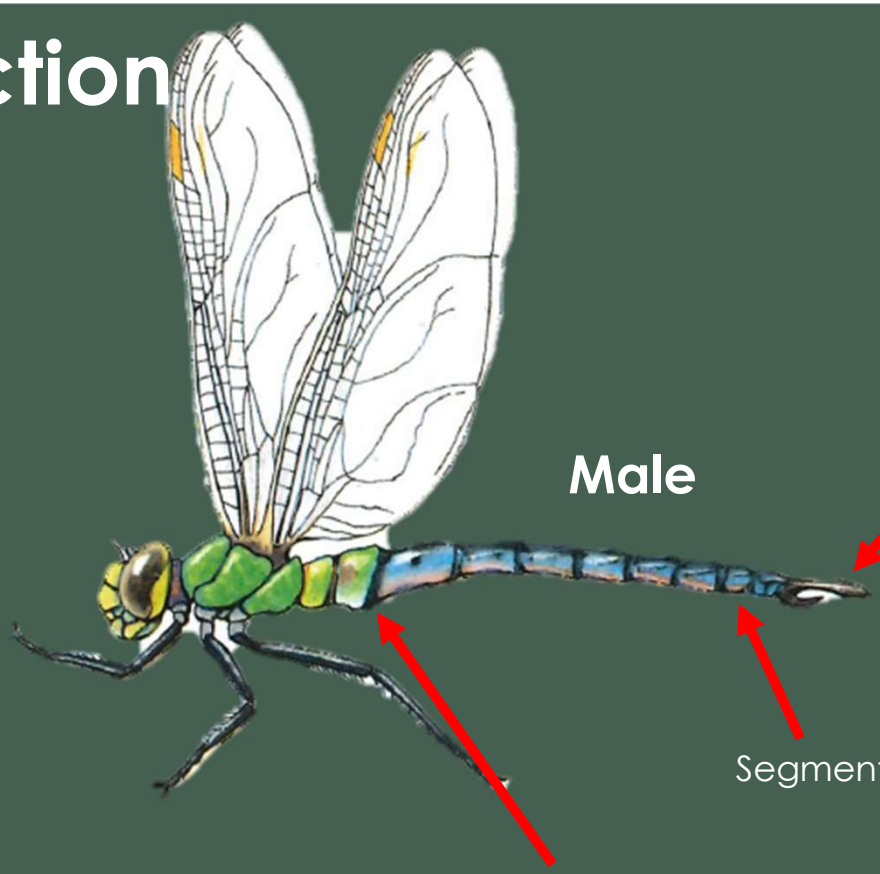
- Live insects
- Opportunistic – whatever is available (usually mosquitoes, flies, flying beetles, flying ants, other dragonflies, butterflies)
- 80-95% predation success rate
  - Wolves ~15%
  - Lions 17-30%
  - Peregrine falcons 47%
- Usually eat 10-15% of their body weight per day



Adults - Reproduction

- Sperm is transferred to Hamulus
- Hamulus – complicated set of "surgical tools" used to fertilize females
- Can also be used to "defertilize" a female from a past encounter

hamulus



Adults - Reproduction

1. Male grasps female near back of her head with his claspers ("lock and key")
2. Female arches abdomen towards male's Hamulus ("the wheel")
3. Depending on the species, some fly into trees and some mate mid-air

Time of fertilization: 15 min to over an hour

The Wheel

Adults - Reproduction

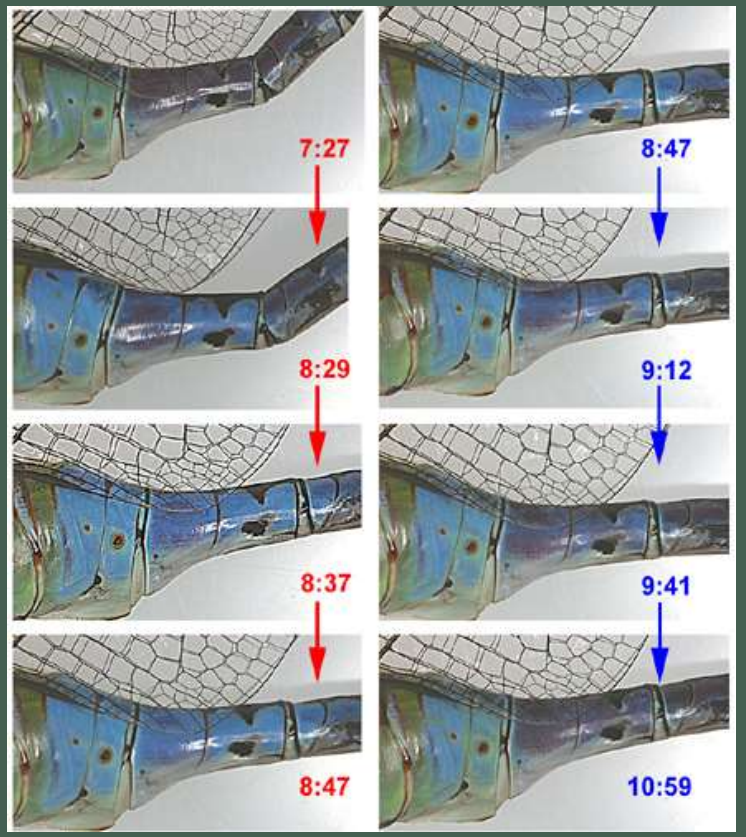
"Guarding"

- Some males leave after copulation, but some stay to guard
- **Contact guarding**: male stays attached to female until egg laying
- **Hover guarding**: male hovers above or near female until she lays eggs
- **Karate guarding**: male clasps onto trespassing males, holding until female lays eggs

Adults- Temperature control

- Like other insects, dragonflies are cold blooded
- Cooling off
  - **Obelisk position:** reduce surface area exposed to sun
- Warming up
  - **Wing whirring:** Vibrate wings to warm up muscles
  - **Bask**: sunbathing

Adults- Temperature control



Adults- Overwintering

Adults die or migrate

Nymphs overwinter underwater

Adults- Migration

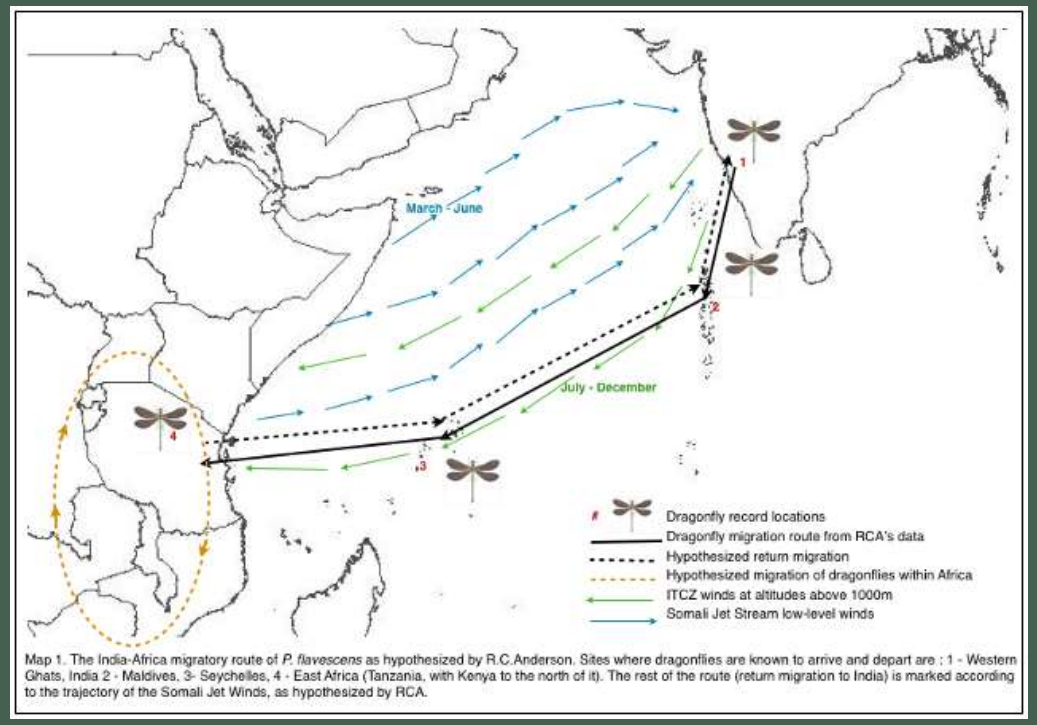
Common green darner

- Migrates from northern areas to Mexico and Texas
- In the fall northern juveniles migrate south together
- Lay eggs in the southern states which emerge and fly north in the spring
- They are some of the first we see in the Northwoods in the spring. Lay eggs before some species emerge. Those eggs are the juveniles that leave that fall

Adults - Migration

Wandering glider

- In Wisconsin, migrate south
- In Africa/India, migrate across Indian Ocean (twice as far as monarch migration) – 2,500 miles each way
- Modified back wings to glide better and expend less energy

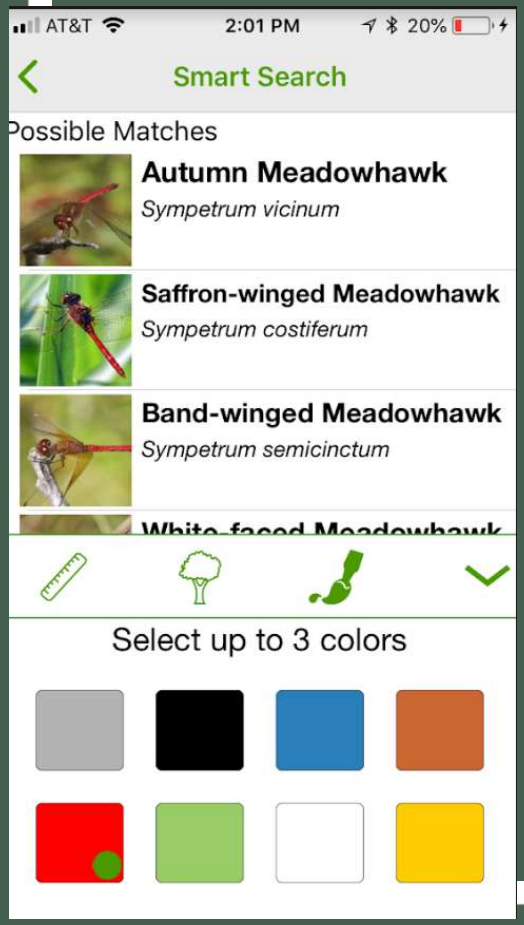


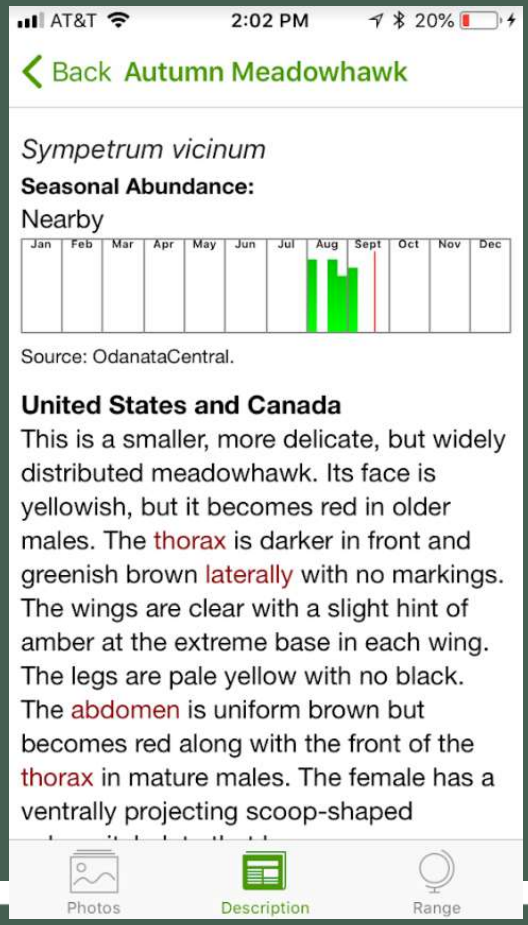
Map 1. The India-Africa migratory route of *P. flavescens* as hypothesized by R.C.Anderson. Sites where dragonflies are known to arrive and depart are : 1 - Western Ghats, India 2 - Maldives, 3- Seychelles, 4 - East Africa (Tanzania, with Kenya to the north of it). The rest of the route (return migration to India) is marked according to the trajectory of the Somali Jet Winds, as hypothesized by RCA.

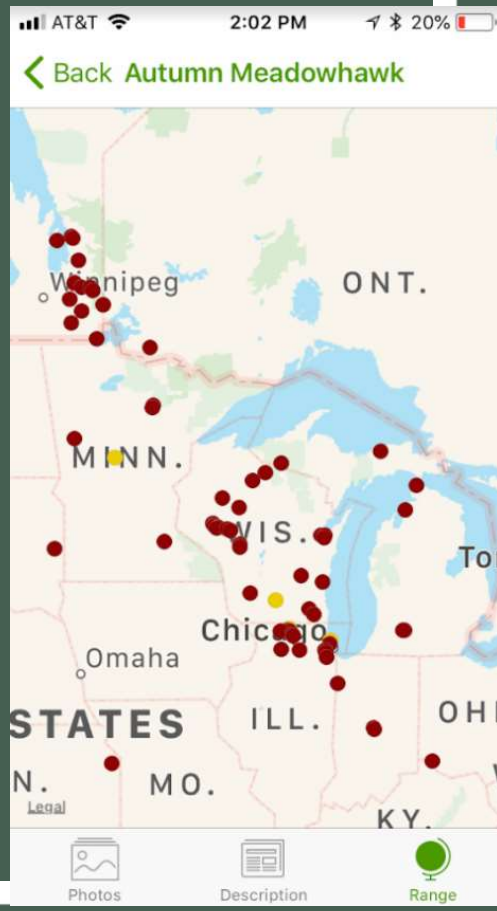
Adults-Identification

- Practice makes perfect
- Net specimens and examine them with a good field guide
- Females and mature adults tend to look different
  - ~115 species of dragonflies, but twice that many "looks" in Wisconsin

App: Dragonfly ID

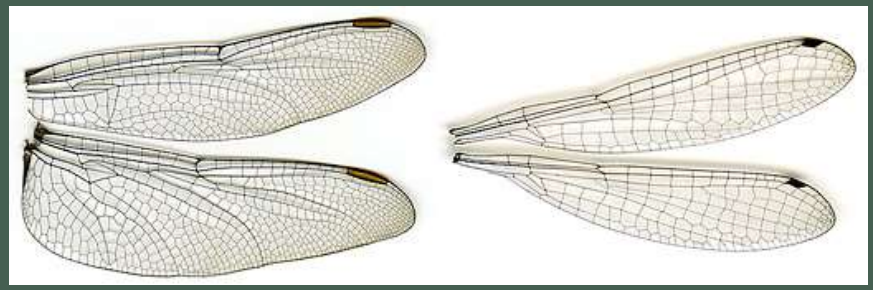






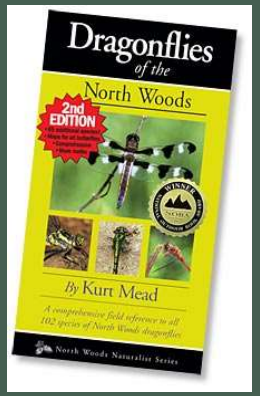
Dragonfly vs damselfly

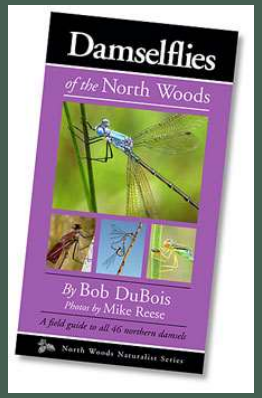
- Eyes: wideset vs close together
- Body shape: dainty vs robust
- Hind wings: similar to front vs more broad
- Wing position at rest: closed vs open

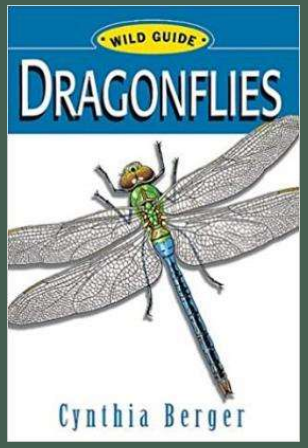


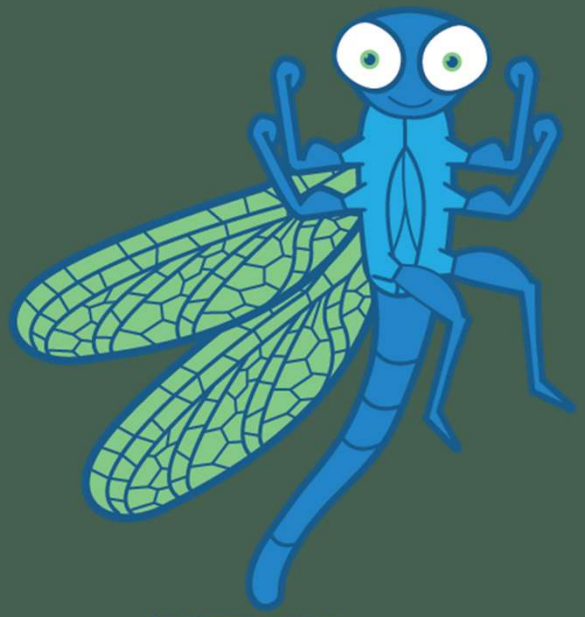
Additional dragonfly resources

- Wisconsin Dragonfly Society
  - http://widragonflysociety.org/
  - Facebook
- Odesforbeginners.com









- https://www.youtube.com/watch?v=Mvu0btxlcng egg laying
- https://www.youtube.com/watch?time_continue=113&v=WS7DnGwl1JI egg hatching 1:53
- https://www.youtube.com/watch?v=EHo_9wnnUTE eating 2:30
- https://www.youtube.com/watch?time_continue=42&v=CyIF7eX6qmo emergence 0.42
- https://www.youtube.com/watch?v=Y0vRupFPw90 leg prey capture 0:30 7 sec
- https://www.youtube.com/watch?time_continue=46&v=oxrLYv0QXa4 wing muscles 0:46