



## Wildlife Classroom Series: Owl Eyes

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Wednesday, March 13, 2013

**Comment:**

All ready for class!

**Comment:**

Yes, Mam!

**Comment:**

Kids are SOOOO ready for class!

**Comment:**

Ready.....lunch in hand!

**Comment:**

Hi Amanda, just got home, slid into my chair and am ready for class!

**Comment:**

Just got here! Can't wait for class today!!!

**Comment:**

Can't wait, Amanda. Should be a very interesting class on Owl eyes!

**Comment:**

Ready!!!

**Comment:**

I'm here

**Comment:**

I'm here until work gets in the way!

**Amanda Nicholson, WCV:**

Welcome to our second Wildlife Center Classroom Series! This session is all about ... owl eyes!

**Amanda Nicholson, WCV:**

So, let me first explain my inspiration for this class topic: in December, I was driving home from Charlottesville, over Afton Mountain on I-64.

**Amanda Nicholson, WCV:**

While I was driving, I spied a little ball of fluff sitting right by the side of the road – on the rumble strip! That was pretty amazing ... because I never seem to spot much of anything.

**Amanda Nicholson, WCV:**

I pulled over and jumped out -- and found a little grey Eastern Screech-owl hunched over. I scooped him up and took a quick peek at his eyes – both of them were in pretty bad shape. I figured the outcome would not be a happy one, and took him right into the Center to see Dr. Dana.

**Amanda Nicholson, WCV:**

She took a quick look at his eyes, which were both severely damaged. Dr. Dana humanely euthanized him. It wasn't an unexpected outcome, after seeing the damage to his eyes.

**Amanda Nicholson, WCV:**

And it got me thinking about how incredibly common eye injuries are to owls ... and how important eyesight is [although owls have some special considerations] ... and well, it just seemed like an interesting class topic!

**Amanda Nicholson, WCV:**

I'm sure that many of you have been mesmerized by owls – their gaze is penetrating! Owls have very large eyes compared to their body size.

**Amanda Nicholson, WCV:**

Our human eyes weigh about 28 grams (one ounce). So that's about 0.08% of our body weight. Very light! If you look at a screech-owl, by comparison – their eyes weigh about .74 grams (.26 ounces) – but that's about 4% of their body weight!

**Comment:**

( \*)>

Wow, no wonder their eyes look so big!

**Amanda Nicholson, WCV:**

Great Horned Owls have the largest eyes of any owl species in the US and Canada. Their eyes are about the same size as a human eye ... but remember an adult human weighs at least 50 times more!



**Comment:**

Owl eyes are haunting.....

**Comment:**

Soooo beautiful!!

**Amanda Nicholson, WCV:**

So what's the advantage of a large eye? Well, they can focus a large image onto their retina. Basically ... good eyesight!

**Amanda Nicholson, WCV:**

Any guesses on what a disadvantage of large eyes would be [for birds]?

**Comment:**

(\*)>

Bright light?

**Comment:**

More injuries, I would guess!

**Comment:**

easily damaged

**Comment:**

can't turn them

**Comment:**

Injuries

**Comment:**

easy injury?

**Comment:**

Big target?

**Comment:**

Air drying them out when flying?

**Comment:**

More likely to be injured?

**Comment:**

Bugs when they ride their motorcycles.

**Comment:**

Maintaining healthy eyes

**Comment:**

Getting poked in the eye by branches!

**Comment:**

injuries from tree branches

**Amanda Nicholson, WCV:**

All good points ... yes, more likely to be injured, and we'll talk about that ...

**Amanda Nicholson, WCV:**

But one big disadvantage is that this makes the eye heavy ... and it takes up a ton of space in the skull!

**Amanda Nicholson, WCV:**

And remember ... it's important for birds to make themselves as light as possible!

**Amanda Nicholson, WCV:**

But owls have some adaptations, of course, that help with this.

**Amanda Nicholson, WCV:**

Most vertebrates have a globular shaped eye. Owls have evolved a tubular shaped eye.



**Amanda Nicholson, WCV:**

The text is a bit tiny there, but the ones on the bottom are the tubular shaped eyes.

**Amanda Nicholson, WCV:**

The tubular eye weighs less – always an important adaptation for birds! -- and it takes up less space in the skull.

**Amanda Nicholson, WCV:**

Despite the difference in shape, this cool adaptation still allows the owl to receive a large visual image -- the distance from the front curvature of the eye to the retina at the back of the eye is about the same as in other vertebrate eyes.

**Comment:**

(\*)>

Does the tubular shape make the more easily injured?

**Amanda Nicholson, WCV:**

The shape doesn't really make them more easily injured ... but the eyes are still quite large, and of course, trauma like impacts with vehicles are quite traumatic!

**Amanda Nicholson, WCV:**

**Amanda Nicholson, WCV:**

Owl eyes are fixed in their sockets – so they are immovable. So you know how you can hold your head still but can still look to the side ... or down ... or up ... ? Well, owls can't do that.

**Comment:**

Owls can't turn their eyes - they have to turn their heads to see around them.

**Amanda Nicholson, WCV:**

Right. And those of you who have been lucky enough to see an owl up close and personal – or via Critter Cam – probably know what the adaptation is that compensates for this lack of eye movement!

**Comment:**

but boy can they turn their heads around!

**Comment:**

They CAN turn their heads most of the way around, though...that must compensate for it a bit, right?

**Comment:**

They can turn their heads 270 degrees (I think).

**Comment:**

they can turn their heads around like Linda Blair in the Exorcist. Lol

**Comment:**

Ha, I remember the day you told my 5th graders that (cam in the classroom session), and they all started moving their heads without moving their eyes

**Amanda Nicholson, WCV:**

Always a fun one to have kids practice!

**Comment:**

Can rotate their heads 270 degrees!

**Amanda Nicholson, WCV:**

Right! Owl's can rotate their heads 270° and see in all directions in order to compensate for their immovable eyes and limited visual field. They can do this without shifting body position.

**Comment:**

Its pretty amazing so see them turn their heads around 270 degrees

**Amanda Nicholson, WCV:**

This sort of amazing movement is possible because they have twice as many vertebrae in their necks than we do. They also have some really amazing vascular adaptations as to not disrupt the blood flow when they're suddenly turning their head.

**Comment:**

There are times as a teacher I wish I could turn my head like that! LOL

**Amanda Nicholson, WCV:**

Many of you saw this article when it came out last month:

[http://www.hopkinsmedicine.org/news/media/releases/owl\\_mystery\\_unraveled\\_scientists\\_explain\\_how\\_bird\\_can\\_rotate\\_its\\_head\\_without\\_cutting\\_off\\_blood\\_supply\\_to\\_brain](http://www.hopkinsmedicine.org/news/media/releases/owl_mystery_unraveled_scientists_explain_how_bird_can_rotate_its_head_without_cutting_off_blood_supply_to_brain)

**Amanda Nicholson, WCV:**

But, back to eyes!

**Amanda Nicholson, WCV:**

Let's talk about eye anatomy:

**Amanda Nicholson, WCV:**

The "orbit" is basically the eye-socket – the hole in the bird's skull where the eye fits in.

**Amanda Nicholson, WCV:**

Within that orbit are about a dozen or so "ossicles" – you can kind of think of these as the "eye bones".

**Amanda Nicholson, WCV:**

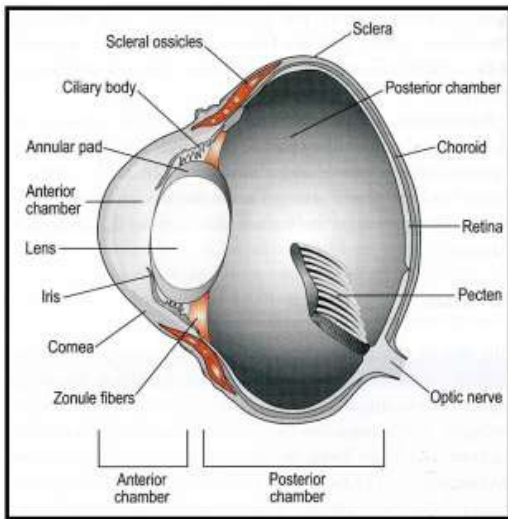
They help support a bird's eye, and also provide some protection from potential impacts. The ossicles determine the shape of the eye – so in owls, these help support those tubular-shaped eyes.



Note orbits [openings where eyes are] and surrounding ossicles.

**Amanda Nicholson, WCV:**

When we talk about the “globe” of the eye, we’re basically talking about the entire eye structure. We sometimes refer to our “eyeballs” ... the more technical term we’re using here for bird eyes is “globe” (makes sense – they’re not really ball-shaped in some cases!)



O’Malley, B. 2005. Clinical Anatomy and Physiology of Exotic Species

**Amanda Nicholson, WCV:**

Now I won't go through all of the parts of the eye ... but we'll hit some highlights.

**Amanda Nicholson, WCV:**

The “cornea” is that outside part of the eye – same as in humans. If you touch your eyeball, you’re touching the cornea.

**Amanda Nicholson, WCV:**

You can see on that photo that the lens is sort of in the middle part of the eye – the lens is large and takes up about 1/3 of the volume within the eye.

**Amanda Nicholson, WCV:**

The iris of the eye is the colored part – just like in our eyes. Birds’ irises have some striated muscle in them that control the amount of light that reaches the back of the eye. The pupil in the owl’s eye can dilate (widen/expand) more than the human eye letting in ~2.7 times more light.

**Amanda Nicholson, WCV:**

Unlike mammals, striated and smooth muscles control the opening of the pupil. So ... eye exams can be tricky for the vets!

**Amanda Nicholson, WCV:**

The color of the iris can vary in owls, as I’m sure you all know -- Barn Owls and Barred Owls have dark brown iris vs. Great Horned Owl and Screech-owls have yellow iris.



Eastern Screech-owls have yellow irises.



Barred Owls have dark brown irises.

**Comment:**

So, Gus' eyes are just that the iris is brown/black, while with Pignoli and GHO's, the iris is 'yellow'. Are reason for this difference with the different species?

**Amanda Nicholson, WCV:**

Right. It doesn't make a difference with how they see ... so I guess really just one more difference in the different species characteristics. Just like differences in feather color.

**Comment:**

Did you guys ever get an answer about why that one Great Horned Owl had grey eyes?

**Comment:**

Was it a GHO patient that had the unusual grey eyes?

**Comment:**

Remember the grey eyed owl patient?

**Comment:**

And then there was that grey-eyed GHO! So there can be 'anomalies' within a species, I suppose

**Amanda Nicholson, WCV:**

Good memories! Yes, we had our unusual grey-eyed Great Horned Owl. Just an anomaly within the species, yes!



**Comment:**

(\*)>

Are pupils round like humans or vertical like cats?

**Amanda Nicholson, WCV:**

Round.

**Comment:**

The owl you had with gray eyes was very different!

**Comment:**

Guess it would be like having a dog or cat with one blue and one brown eye.

**Amanda Nicholson, WCV:**

The “retina” is located on the back wall of the eye -- this is where visual input is converted into chemical signals and sent to the brain.

**Comment:**

I know rods and cones ( I think) are involved.

**Amanda Nicholson, WCV:**

Right! The retina possesses two kinds of light-sensitive cells:

**Amanda Nicholson, WCV:**

Rods: are sensitive to the lowest light levels and therefore specialize in night vision.

**Amanda Nicholson, WCV:**

Cones: help produce sharp, color images and require high levels of light to be stimulated.

**Amanda Nicholson, WCV:**

Humans have a higher proportion of cones (responsible for daytime vision and acuity) in the retina when compared with owls.

**Amanda Nicholson, WCV:**

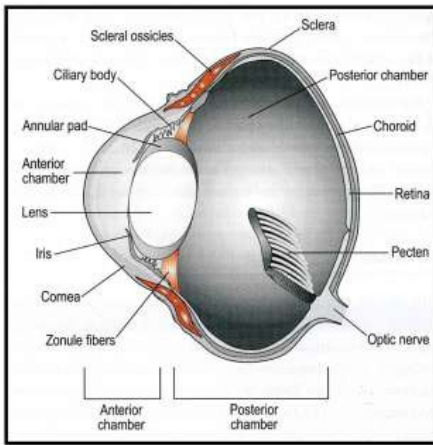
In birds, the retina is “avascular”, which means it is not supplied directly with blood vessels. This is different from the human eye which is vascularized.

**Amanda Nicholson, WCV:**

The vitreous is a clear jelly-like substance that fills the back part of the eye – between the lens and the retina.

**Amanda Nicholson, WCV:**

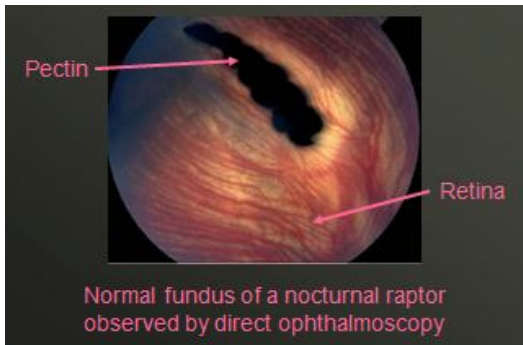
The “pecten” is a moveable structure thought to provide nourishment.



O'Malley, B. 2005. Clinical Anatomy and Physiology of Exotic Species

**Amanda Nicholson, WCV:**

So what's some of that really look like?



Normal image of eye [using retinal camera]

**Amanda Nicholson, WCV:**

The pecten is the thing that sort of looks like a fuzzy caterpillar!

**Comment:**

Gross.

**Comment:**

(someone has it labelled as "pectin"...thickened eye jelly \*g\*)

**Amanda Nicholson, WCV:**

(there's no accounting for student spelling sometimes ...)

**Amanda Nicholson, WCV:**

And lastly, we have the "Fovea" – this is the region in the retina a high density of photoreceptors required for fine vision. So, basically fovea = important. When this area is damaged in a raptor, it is often a devastating injury.

**Amanda Nicholson, WCV:**

Owls have a single fovea. Hawks and eagles have two fovea in each retina. Daytime birds rely very heavily on their incredible eyesight for hunting and finding food.

**Comment:**

I can't agree with GN :) I think this is fascinating not gross

**Comment:**

Clinical

**Amanda Nicholson, WCV:**

Yes ... so that all gets a bit clinical. And I'm sure you've heard us use some of those terms from time to time when we're describing patient injuries on the website.

**Comment:**

Owls see in color?

**Amanda Nicholson, WCV:**

Well, they don't have as many cones as we do in our retinas ... so most owls see in limited color or in monochrome.

**Comment:**

I should say clinical = important facts

**Amanda Nicholson, WCV:**

So how well can they see ... and how does that compare to us?

**Amanda Nicholson, WCV:**

Raptors have front-facing eyes, which allows them to have a "binocular vision", like humans do.

**Comment:**

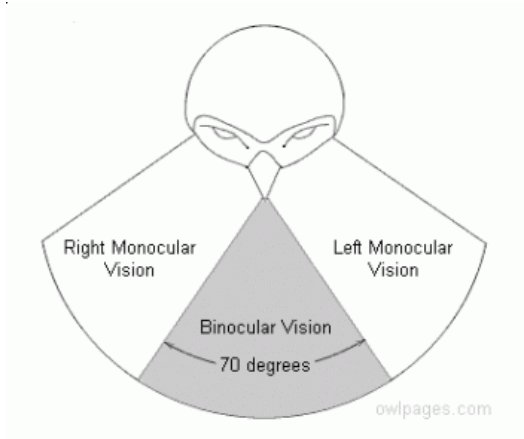
Since they can't move their eyes, do they have peripheral vision? And if so, how good is the peripheral vision?

**Amanda Nicholson, WCV:**

In binocular vision, the fields of view of the left and right eye overlap. Animals with eyes on the sides of their head (usually prey species) have low binocularity, but a really wide field of view. That makes sense ... since they're on the look-out for predators most of the time!

**Amanda Nicholson, WCV:**

The right-eye and left-eye visual fields of an owl overlap about 70 degrees, (in human vision, this overlap is about 120 -- 140 degrees). So peripheral vision isn't as good as ours ... but remember, they can very quickly whip their head around to check out what's going on!



From the Owl Pages [[www.owlpages.com](http://www.owlpages.com)]

**Amanda Nicholson, WCV:**

Binocularity allows for "stereoscopic vision" (3D affect!), which in turn allows for determination of distance.

**Amanda Nicholson, WCV:**

When an owl (or a human) compares the slightly different images from the right and left eye, its brain automatically determines the distance to the object.

**Amanda Nicholson, WCV:**

This type of vision may be critical in environments where there are many obstacles that need to be avoided.

**Comment:**

wow--this is really in-depth today! I hope we all have our thinking caps on so we can soak all this info in! It's fascinating!

**Comment:**

Is that why they can see so well at night? more light is getting in..

**Amanda Nicholson, WCV:**

Well, owls have lots and lots of rods in their retina – as we just went over, rods are very helpful for seeing in low-light conditions. And of course remember, the owls can allow more light in through their pupils. So they can pick up really low levels of light and utilize them.

**Comment:**

I am finding myself trying to stare straight ahead and turn my head to see where my peripheral vision ends

**Comment:**

OK, I\'m sitting here winking both eyes at my potted plant across the room to check out the overlap vision!

**Amanda Nicholson, WCV:**

Ha -- you guys do think alike!

**Comment:**

So when an owl has focused in on prey and going for the catch they can use the Binocular field of their vision to judge distance?

**Amanda Nicholson, WCV:**

Well, owls really do rely a lot on their great sense of hearing to hone in on food. But that binocular vision allows them to judge distances to maneuver around things, or perch, etc.

**Comment:**

So. owls see mostly in monochrome, not color? Just learned that

**Amanda Nicholson, WCV:**

That's the thought, yup.

**Amanda Nicholson, WCV:**

From the human perspective, it is not that we can't see in the dark/low light levels, but we usually don't give ourselves enough time to fully adapt to the dark.

**Amanda Nicholson, WCV:**

It takes about 30-45 minutes for the human eye to become completely adapted to darkness. Once we are dark-adapted our nocturnal vision can increase 10,000 times (100 fold) within 10 minutes and then another 100 fold within the next 30 minutes.

**Amanda Nicholson, WCV:**

If we look at a light for even a brief period of time the retina must readjust and the rods must regain their sensitivity to the dark.

**Amanda Nicholson, WCV:**

We know owls have large, frontally-directed globes, which allow for acute vision for predation.

**Amanda Nicholson, WCV:**

So ... any guesses in terms of what this could mean for injuries?

**Comment :**

globe first into a moving car

**Comment:**

They're so focused on their prey that they don't see things at the side--like branches?

**Comment:**

Not seeing things like cars coming from the side?

**Comment:**

You mean like they can have eye damage as a result of hitting tree branches and limbs and bugs and such?

**Comment:**

More area exposed to dangerous stuff

**Comment:**

Any kind of head trauma probably damages the globe's attachment within the skull?

**Amanda Nicholson, WCV:**

Right. This predisposes raptors to ocular lesions from head trauma. Remember, they can't move their eyes either ... so an owl would have to move its head to compensate for a potential impact.

**Amanda Nicholson, WCV:**

In 2012, we admitted 108 owls – Barn Owls, Barred Owls, Great Horned Owls, Northern Saw-whet Owls ... and of course, our “chart-toppers” – Eastern Screech-owls. Screech-owls are typically one of the most common types of raptors we see (66 in 2012).



Eastern Screech-owl [actually Alex, before she was "Alex"]

**Amanda Nicholson, WCV:**

About 41% of those owls admitted in 2012 had eye injuries. As you now know ... eyes take up a lot of “real estate” in a raptor’s head, so this makes some sense!

**Amanda Nicholson, WCV:**

At least 44% of the owls admitted in 2012 were hit by a vehicle. It could be more than that, but of course, we don’t always know the circumstances surrounding a patient’s admission.

**Amanda Nicholson, WCV:**

Hit by vehicle (HBV) was the most common cause of admission for the screech-owls – 66% of them were HBV. 68% of those HBV cases had eye injuries as a result.

**Amanda Nicholson, WCV:**

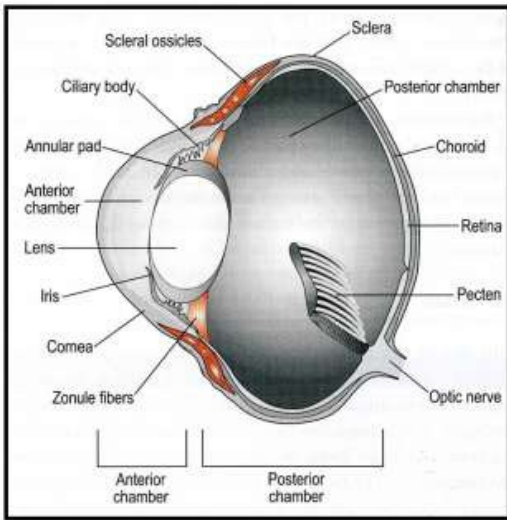
Other studies (not here at the WCV) have shown that an average of more than 30% of all traumatized birds have ocular issues.

**Amanda Nicholson, WCV:**

88-90% of eye disorders found in wild raptors can be linked to traumatic causes -- collisions with automobiles, windows, trees, buildings, etc.

**Amanda Nicholson, WCV:**

Studies show that the majority of ocular injuries in raptors are found in the back half of the eye.



O'Malley, B. 2005. Clinical Anatomy and Physiology of Exotic Species

**Amanda Nicholson, WCV:**

So while an impact could still definitely injure the front part of the eye, the third-eye lid of the owl (yup, third eye-lid in owls too!) tries to offer some protection from this. The structures in the back part of the eye can be injured when the eye is compressed -- and the fixed fluid volume in the eye is moved. This sort of movement might produce a tear in tissues.

**Comment:**

Well, I do know owls (and other raptors) have 3 eyelids :)

**Comment:**

Owls blink SO slowly! Is there a purpose in that?

**Amanda Nicholson, WCV:**

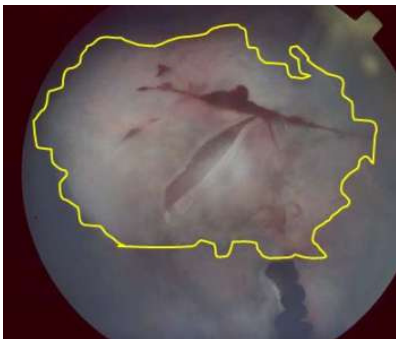
That third eyelid is working hard to offer extra protection!

**Comment:**

Can an owl's retina get detached like a human retina sometimes does?

**Amanda Nicholson, WCV:**

Yup, definitely. We tend to see a good number of retinal detachment. Essentially, this is a moving away of the retina from the back layer/outer wall of the eye, and it affects vision.



Retinal detachment.

**Amanda Nicholson, WCV:**

Retinal detachments usually just take a bit of time – if they are going to heal, they'll do so quickly (will reattach in a few days). If the retina does not reattach ... well, the injury could get worse over time, or it could be stable and only affect a limited portion of the bird's vision [blind spot].

**Comment:**

It would make sense since when birds fly, their head is out front. I would imagine, Newton's Laws come into effect when they hit something - the back part of the eye would still be moving, hence, causing damage.

**Amanda Nicholson, WCV:**

Right!

**Comment:**

but what is cause and what is effect, wouldn't vision problems be a cause of HBV, as well as a result?

**Amanda Nicholson, WCV:**

Well, I suppose vision problems could be a cause of being HBV in some cases ... but for the most part ... think about what owls are doing near the road.

**Amanda Nicholson, WCV:**

Most of them are hanging out ... looking for food.

**Amanda Nicholson, WCV:**

I think we tend to see more owls HBV in the winter time -- when food is a little harder to come by.

**Amanda Nicholson, WCV:**

And you have those little rodents out there just feasting on the trash that humans throw out of their cars ...

**Amanda Nicholson, WCV:**

And while they hone in on their dinner ... a car comes by. While we may think, "hey, why not get OUT of the way!" ... remember, owls don't think in human-terms. They don't know what cars are!

**Comment:**

is there a medical procedure to repair a detached retina?

**Amanda Nicholson, WCV:**

Not in the case of wildlife at least ... it's sort of a "wait and see".

**Comment:**

The one horrible time that I almost hit a screech owl, it was summer and it was pursuing a moth across a road and wasn't looking out where it was going...afraid the mothe might hav been attracted to my headlights.

**Amanda Nicholson, WCV:**

In terms of other types of injuries ...

**Amanda Nicholson, WCV:**

Vitreous hemorrhage. This is the leaking of blood into the vitreous gel filling the space between the lens and the retina.

**Amanda Nicholson, WCV:**

Uveitis. This is an inflammation of the uvea/middle layer in the eye.



**Amanda Nicholson, WCV:**

We also sometimes see owls with corneal ulcers – when that very outside part of the eye is scratched in some way. Some humans have experienced corneal ulcers – they can be quite painful!

**Comment:**

Do owls develop cataracts like humans?

**Comment:**

What about cataracts? Do owls ever get them? My little Westie has cataracts and went blind

**Comment:**

I know dogs and other animals get cataracts due to heredity, but what about owls?

**Amanda Nicholson, WCV:**

They do occasionally, though this doesn't happen as frequently. We don't tend to see a lot of "old age" problems in wildlife patients -- so this might be something we see in some elderly edu animals.

**Amanda Nicholson, WCV:**

We did also have an education owl that was hatched with cataracts -- so she just had some congenital deformities. That's not common.

**Amanda Nicholson, WCV:**

There definitely are a wide range of eye injuries ... Bottom line: with so many different structures in the eye ... there can be a variety of parts damaged when an owl experiences head trauma.

**Amanda Nicholson, WCV:**

And of course, it's important for the vets to remember that eye injuries as a result of head trauma may point to other health complications – like a loss of hearing.

**Amanda Nicholson, WCV:**

On average, owls with treatable eye injuries (go on to be released) are hospitalized 62.4 days, judging by our 2012 numbers.

**Comment:**

So, how are the vets able to ascertain the amount of damage to an owl's eyes? How can you tell it 'can't see'?

**Amanda Nicholson, WCV:**

This is a GREAT question.

**Amanda Nicholson, WCV:**

Eye exams are so, so important. Sometimes you can obviously tell if something is going on – you see a scratch, or the globe is damaged ... but that's all the stuff in the front part of the eye.

**Amanda Nicholson, WCV:**

Remember, there's a whole "back half" ... and you can't just tell by looking at the owl's eye without special equipment!

**Amanda Nicholson, WCV:**

Here's a good example:



Can you tell what's wrong with her eyes?

**Amanda Nicholson, WCV:**

Just to look at Athena .. there is nothing visibly wrong with her eyes. There is no blood, there are no ulcers, no deflated/damaged globes.

**Comment:**

Not me.

**Amanda Nicholson, WCV:**

But inside ...



An image of Athena's right eye, taken with the retinal camera

**Amanda Nicholson, WCV:**

The dark structure in the bottom of the image is the pecten. It helps distribute nutrients throughout the eye. The lighter colored region above this is an area of degeneration with some pigment deposition. The pigment is the owl's way of trying to heal the degeneration, but it is not normal retina. Athena has areas of degeneration like this throughout her eyes.

**Amanda Nicholson, WCV:**

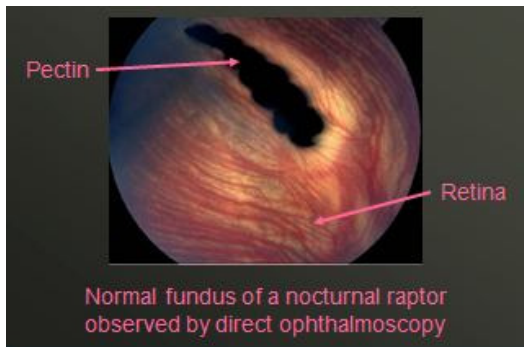
Now that was a Dr. Rich description. And of course, I know that the image is a bit lost on us ... it's like me trying to read radiographs. I can only tell if something is really really really wrong. The subtleties are lost on me ... but hey, I'm not a vet!

**Amanda Nicholson, WCV:**

The point is, we're fortunate, that as a wildlife hospital, we have a good variety of eye equipment.

**Amanda Nicholson, WCV:**

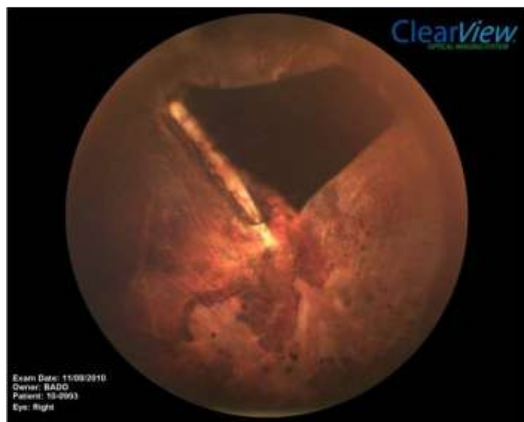
So we can look at all of that stuff ...



Normal image of eye [using retinal camera]

**Amanda Nicholson, WCV:**

If that's normal ...



Injured Barred Owl eye. Abnormal shape of pecten.

**Amanda Nicholson, WCV:**

We have tools so we know that if we look in an owl's eye and see that -- well, there is a problem!

**Amanda Nicholson, WCV:**

You guys have probably seen tons of photos of eagle eye exams – that's because the vets tend to do their physical exams on all patients in a specific order. That way they don't miss things.

**Amanda Nicholson, WCV:**

Eyes are a great place to start, just so we know what type of injury we're up against. So you've probably seen a lot of these:



The tonovet is used in every raptor examination to check eye pressure.

**Amanda Nicholson, WCV:**

This is our Tonovet – it is used to measure the pressure within the eye [intraocular pressure]. The machine uses a tiny probe to lightly tap against the cornea of the bird. It takes six quick readings and then gives us an average pressure.

**Amanda Nicholson, WCV:**

We expect to see a decrease in intraocular pressure with uveitis (inflammation within the eye) and an increase with anything that interferes with the production or movement of fluid within the eye. Intraocular pressure can also increase if the systemic blood pressure is increased (stress, pressure on the vessels in the neck).

**Amanda Nicholson, WCV:**

The vets will also sometimes do a Fluorescein staining, which uses a fluorescent dye as a diagnostic aid for corneal trauma. This is great for visualizing corneal ulcers.



Fluorescein-stained eye to check for corneal ulcers.

**Comment:**

Are there meds that bring pressure down like in humans?

**Amanda Nicholson, WCV:**

Yes, we have a variety of eyedrops that have different functions.

**Comment:**

I like that look.

**Comment:**

(\*)>

I hope that is not as painful as it looks!

**Amanda Nicholson, WCV:**

Well, the test isn't painful, but corneal ulcers definitely are! The vets use pain meds in these cases to keep our patients comfortable.

**Comment:**

I'll bet many of us have had similar eye exams.

**Amanda Nicholson, WCV:**

Right!

**Amanda Nicholson, WCV:**

The vets will also use a light to test the bird's pupillary light reflexes – when the diameter of the pupil changes in response to the amount of light reaching the retina. That's what allows them to adjust to varying light levels.

**Amanda Nicholson, WCV:**

We also have a direct ophthalmoscope – which allows the vets to see inside of the eye – all the way back to the retina, fovea, etc. It's a heavily used piece of equipment!

**Amanda Nicholson, WCV:**

We also have a slit lamp. This piece of equipment is used to observe changes in the inner eye structures that cannot be readily visualized using standard direct methods. With this tool, the veterinarian can diagnose cataracts in the lens at a much earlier stage of development and painful ulcers on the outer cornea layer of the eye. Due to the large number of ophthalmic injuries the Center sees in avian patients, this is a very important diagnostic tool.

**Comment:**

awesome eye images..course, figures GN would like the green one.

**Amanda Nicholson, WCV:**

There are also several other special lenses and a head lamp [hands free!] that us allow to see those inner eye structures. And we also have this lovely retinal camera, so we can take photos for educational purposes and for monitoring purposes!



Dr. Miranda and Dr. Adam test out the new retinal camera [2012].

**Amanda Nicholson, WCV:**

So, we talked about how retinas might reattach ... or might not. Some of you guys may have been a sponsor of one of our special patients in need – we tend to use a lot of Screech-owls for this special type of Caring for Critters adoption, because if they have a retinal detachment, they tend to be with us for awhile!

**Amanda Nicholson, WCV:**

It's our policy with those types of injuries that we keep the bird for three months, so we can observe. We don't want to release an animal with an eye injury that might get worse over time – so three months is a nice period of observation to ensure the injury is stable.

**Amanda Nicholson, WCV:**

Sometimes, when an eye is very badly damaged, or possibly infected, the vets have to remove the eye entirely. There are a couple of techniques we can use to remove the eye ... anyone know the two techniques?

**Comment:**

Grapefruit spoon?

**Amanda Nicholson, WCV:**

Oh my goodness.

**Amanda Nicholson, WCV:**

I know Lynda knows ...

**Comment:**

enucleation

**Amanda Nicholson, WCV:**

Yup, that's one!

**Amanda Nicholson, WCV:**

Enucleation is the removal of the entire globe. That might be a fine option for a bird that won't be released – for example, Pignoli has an enucleated eye.

**Amanda Nicholson, WCV:**

But the problem for doing this procedure on an owl that might be potentially releasable is that it disrupts the shape of the facial disc, which is very important in maintaining an owl's ability to hear.



Pignoli has an eye enucleation

**Comment:**

one is covering the eye with it's lid, the other is removing the globe..but can't do that if the raptor is to be released as will affect their hearing

**Amanda Nicholson, WCV:**

So that other technique ... any one know what it's called?

**Amanda Nicholson, WCV:**

Also begins with an E ...

**Comment:**

Eyepatch?! :o)

**Amanda Nicholson, WCV:**

ha ... no ... Evisceration!

**Comment:**

evisceration of eye contents (I am using human medicine guesses here)?

**Comment:**

evisceration is the removal of organs - is that it?

**Comment:**

OMG! I was thinking eviserate, but didn't think that would be it!!

**Amanda Nicholson, WCV:**

Ah, see, not all terms are different!

**Amanda Nicholson, WCV:**

So for those birds, the vets will perform an evisceration of the eye – in simple terms, this is sort of just removing the “guts” of the eye – the cornea, lens, vitreous, uvea, and retina.

**Amanda Nicholson, WCV:**

This procedure maintains facial disc shape because the shape of the orbit stays intact as well as those important ossicles. It's also a shorter surgery.

**Comment :**

that is kind of a violent sounding word!



Eastern Screech-owl with eye evisceration



Evisceration of Barred Owl eye.

**Comment:**

Treatment/procedural question: I seem to recall from some questions my class asked about Pignoli, that Dr. Ali removed her eye, but Alex had similar eye injuries and her eye wasn't removed. Has WCV changed their approach regarding eye removal?

**Amanda Nicholson, WCV:**

Well yes ... and no. In terms of Pignoli vs. Alex, Alex has some permanent blind spots in both eyes, which make her non-releasable, but her eyes are basically "healthy".

**Amanda Nicholson, WCV:**

In Pignoli's case, her one eye was not in good shape -- and to reduce risk of infection and future problems -- it was removed.

**Amanda Nicholson, WCV:**

Now the techniques have changed over the year -- year and years ago, vets did more enucleations. But the research and literature and studies all pointed to issue with that (maintaining shape of face)

**Amanda Nicholson, WCV:**

That's what I love to hear ... and emphasize in all of our classes ... this is a field where you really have to stay on top of your game! Things change and techniques improve -- for the better!

**Comment:**

(Do you know how many one-eyed owl art projects are made at Desert Valley? - especially with the right eye missing? LOL)

**Amanda Nicholson, WCV:**

Ha!

**Comment:**

so does that mean their hearing is not damaged?

**Amanda Nicholson, WCV:**

Right. Evisceration also has much less of a change of affecting the hearing.



**Comment:**

So, does WCV do more eviscerations or enucleations these days?

**Amanda Nicholson, WCV:**

Evisceration, all the way.

**Amanda Nicholson, WCV:**

So ... I know this brings up the big question of releasability. And this is my last section for the class too ...

**Comment:**

An owl can survive with only one eye? Doesn't that significantly reduce its depth perception? Can it still hunt successfully?

**Comment:**

(\*)>

Can eviscerated owls survive in the wild? It seems like a terrible disadvantage.

**Comment:**

If there is slight damage to the retina but not the fovea and owl could still hunt?

**Comment:**

How impaired does an owl's sight have to be before it's considered non-releasable vs humanely euthanized?

**Comment:**

Having only one functioning eye would be a great disadvantage but would an owl be able to make it in the wild with one good eye?

**Amanda Nicholson, WCV:**

So, the interesting thing about eye injuries in owls is that it's not automatically a "no release" situation. We know that "3D" stereopsis vision is due to their binocular overlap between the eyes. The diurnal –daytime – birds like hawks and eagles rely so much on their eyesight, that a 'blind spot' typically makes them non-releasable.

**Comment:**

We know that eagles can see with great accuracy at long distances. How does owl eyesight compare?

**Amanda Nicholson, WCV:**

Remember, those eagles and hawks have a slightly different eye structure -- and they have two fovea.

**Amanda Nicholson, WCV:**

So their eyesight is much more sharp -- and they are dependent on it.

**Amanda Nicholson, WCV:**

But owls ... well, owls of course use their eyesight, but they also rely very heavily on their ability to hear their prey. That really enables them to hone in on where the food is. There has been studies that show that as long as owls have one good eye and can hear, they can successfully hunt and survive.

**Comment:**

(\*)>

Do the owls adapt quickly after evisceration? All I can think of is some poor owl bumping into things in its recover cage...

**Comment:**

(\*)>

I meant how quickly they adapt.

**Amanda Nicholson, WCV:**

Right -- it's definitely not a case where we do surgery and throw them right back out there -- it's a good recovery process!

**Amanda Nicholson, WCV:**

When these sorts of patients come to us -- whether they have one good eye and one blind-spot eye, or if they only have one eye period -- we carefully monitor them during their exercise sessions, to ensure they can successfully navigate around obstacles.

**Amanda Nicholson, WCV:**

And of course all raptors go through a live-prey testing; this is absolutely critical for owls with eye injuries.

**Amanda Nicholson, WCV:**

When they are able to successfully make their way through those "tests", then we will release them.

**Comment:**

lots of analogies with human medicine..constant change and improvemets and always have to keep up

**Comment:**

Do you use the hanging noodles to test owls with eye injuries?

**Amanda Nicholson, WCV:**

Yes -- good call!

**Amanda Nicholson, WCV:**

We have some pool noodles hanging in our exercise yard -- they mimic trees in the forest. A very soft way of testing if owls can maneuver!

**Comment:**

(\*)>

Mouse school is my favorite test.

**Comment:**

(\*)>

How could I forget about mouse school?!

**Amanda Nicholson, WCV:**

So that's what I have prepared for our slightly-longer-than-an hour eye class! I'll delve through some questions ... but thanks so much everyone for attending!

**Amanda Nicholson, WCV:**

Right, and we have leaves in all of our buckets. So it makes it a bird harder ... and more realistic.

**Comment:**

but would the live prey be easier for a seeing impaired bird to find in a black bucket? In the wild their prey will hide and stuff right?

**Comment:**

Eye think this has been a great class. Sorry The Face missed it.

**Amanda Nicholson, WCV:**

Me too.

**Comment:**

great info Amanda

**Comment:**

Awww poor little owl - but thankfully you allowed him to die humanely.

**Amanda Nicholson, WCV:**

Oh and back to that owl --

**Amanda Nicholson, WCV:**

Yes. Knowing how bad those injuries were ... I didn't feel as sad about having to euthanize him as I did about thinking of him sitting on the side of the road.

**Amanda Nicholson, WCV:**

That must've been fairly scary! So at least I felt good that he wasn't out there for hours more in that sort of environment.

**Amanda Nicholson, WCV:**

And if he was the inspiration for this class, well, basically he taught a lot of people!

**Congowings:**

Great class Amanda. It was wonderful!!!

**Comment:**

When an owl has had an eye removed at the center like Pignoli for example, has anyone ever weighed the eye to get a general idea of the weight? Just curious...

**Amanda Nicholson, WCV:**

I don't know that we did any individual weighing, but we do know that their eyes weigh about .74 grams. Owls are lighter after surgery!

**Comment:**

Amanda, what about Snowy Owls? What color are their eyes?

**Amanda Nicholson, WCV:**

Golden yellow.

**Comment:**

We all know how important the owl's sense of hearing is to them. How do their ears differ from other birds

**Amanda Nicholson, WCV:**

Many species of owls have asymmetrical ears -- so one is higher than the other. This helps them hone in on where the food sounds are coming from!

**Amanda Nicholson, WCV:**

Oh shoot! I forgot to change my avatar ...

**Amanda Nicholson, WCV:**

This goes with my whole releasability section.

**Comment:**

LOL - forgetting to change avatars seems to be contagious with our teachers!

**Comment:**

Still catching up, but terrific class, Amanda - and with Congo's squirrels, two great classes back to back!

**Comment:**

( \*)>

I need to log off for a while. Thank you for the wonderful class, Amanda!

**Congowings:**

Oh, very clever Amanda!!

**Amanda Nicholson, WCV:**

I hope you all enjoyed our Owl Eyes class! And I hope that in the future, as you follow the website, or adopt your special Caring for Critters, this will help you understand some of the nature of the injuries we see here at the Wildlife Center.



Thanks for attending!

**Comment:**

Ahhh! The one eyed owl!

**Comment:**

How many "students" did you have online for class?

**Amanda Nicholson, WCV:**

312

**Comment:**

A great class and I learned a lot. Thank you, Amanda!

**Comment:**

Learned a lot again today....thank you Amanda. What's on the agenda for next session....hmmmmmm...maybe a study of the turkey vultures head...LOL

**Amanda Nicholson, WCV:**

You just never know!

**Comment:**

Thank you Amanda for a great class!

**Comment:**

Kudos to both of you! 2 great classes 2 days in a row. (And I see you have your owl on today Cong, though I rather liked the squirrel)

**Comment:**

Awesome class, Amanda! I really learned a lot! (but my third graders still think Pignoli should get glasses. LOL)

**Comment:**

Thanks for your time, Amanda. Great class! Love Owl eyes....it's what I see in my back yard at night...it's ALL I can see of a resident owl!! lol

**Comment:**

Thank you so much Amanda really good information, thanks for taking the time with us....

**Comment:**

Great class Amanda! Thanks!! I am on owl eye overload....still processing!! :-)

**Comment:**

amazing 'owl eye' class AA. thank you. i hope it will be archived, there is no way my senior brain can absorb all of this info in such a short time. i would need to re-read. again thank you for this awesome info!

**Amanda Nicholson, WCV:**

Yes, we will archive it! I think it should be helpful to point too with future updates too!

**Comment:**

Thanks AA. Clap, Clap, Clap...In honor of Gus and Athena, my adopted critters

**Comment:**

Thank you Amanda for teaching us about Owl Eyes!!!

**Comment:**

Really nice class, Amanda! Thanks so much. Both avatars, yours and Congo's are great!

**Comment:**

(\*>  
It was a great class. Thanks, Ms. Amanda!

**Comment:**

Kids had a WONDERFUL time in class today, Amanda, thank you so MUCH! We have a LOT to talk over and discuss after this session! You are the BEST!

**Comment:**

I really enjoyed the Owl eye class. So much to learn, and you've made it enjoyable!

**Comment:**

Excellent presentation. TKS

**Comment:**

Wonderful class, Amanda! Thanks for all your knowledge and preparation.

**Amanda Nicholson, WCV:**

Oh goodness -- and let me say -- special thanks to former preceptor (rehab extern) Travis Kelter.

**Amanda Nicholson, WCV:**

Some of you may remember Travis from two summers ago --

**Amanda Nicholson, WCV:**

And he's back in Canada and really still wanted to help out. So he's been working with me on an information-gathering venture ...

**Comment:**

Amanda-Thanks SO much for the class! It was an "eye opener" to owl eyes! Lots of interesting information!!!

**Comment:**

Out of a tragedy, many are taught. Bless that poor little owl

**Comment:**

Thank you so much. Hope there isn't gonna be a test later. Great presentation.

**Comment:**

Excellent class Amanda, did realize there was so much to the eye.

**Comment:**

Thanks Amanda!! Very interesting class!!!

**Comment:**

Thanks AA Great class

**Comment:**

( \*)>  
What a great class! Thank you very much, Ms. Amanda!

**Comment:**

Wonderful information Amanda- thanks so much! Great classes both days ;-)

**Comment:**

Thank you, Travis!

**Comment:**

Does someone 'test' them at night as well as during the day so they can see at night?

**Amanda Nicholson, WCV:**

That's an interesting thing ... no, we don't test them at night ... but I'm afraid we'd not be able to see as well as them -- it might not be revealing to us!

**Comment:**

Enucleation --Is that why Pignoli's facial disk look a little lopsided?

**Amanda Nicholson, WCV:**

Yes, I think so. And his little feather tuft is always droopy on that side!

**Comment:**

What were the specific injuries to the eyes of the owl you brought in?

**Amanda Nicholson, WCV:**

I'm actually not sure. I know that one glove was completely destroyed ... and I could readily see blood in the other eye. So all "front end" stuff ...

**Comment:**

Amanda, will Athena eventually go blind?

**Comment:**

So Athena's eyes have a degenerative condition in lieu of a condition caused by head trauma?

**Amanda Nicholson, WCV:**

No, she's nice and stable ... but yes, we do think that she may have contracted West Nile Virus. So not head trauma.

**Comment:**

( \*)>

Wow, I was so busy thinking about eye injuries, I didn't even consider other effects of head trauma, like hearing loss? Is there a way to tell if an owl also has hearing loss?

**Comment:**

Oooo - hadn't thought about the potential for hearing loss. How do you determine "how much" and would an owl be releasable if it had hearing loss?

**Comment:**

How can a vet tell if an owl can hear well enough to be released?

**Amanda Nicholson, WCV:**

Usually the first indication to us is that they won't pass live prey testing (so important!)

**Amanda Nicholson, WCV:**

And when that's the case ... we go further. We have taken a few owls to Virginia Tech before since they have specialized equipment to help with that. We have found some deaf/partially deaf owls before.

**Comment:**

With a torn retina, is laser treatment to re-attach an option?

**Comment:**

Would you remove the cataracts from a wild animal?

**Amanda Nicholson, WCV:**

Not in the case of wildlife. In a lot of these sorts of cases, the human medicine might be there -- but there hasn't been a lot done in wildlife. And when humans go to the doctor for these big issues ... well, you go back after the procedure. And again. And again. And continue check-ups.

**Amanda Nicholson, WCV:**

And we don't have that option in wildlife ... so to do something that has an unknown outcome, and then release the animal -- well, that wouldn't be responsible on our part.

**Amanda Nicholson, WCV:**

And while I supposed we could do that for a non-releasable animal ... it's quite expensive. So if we don't have to ...

**Comment:**

thanks for the great class Amanda!!

**Comment:**

do they suture lid closed then?

**Amanda Nicholson, WCV:**

After the evisceration, the vets will perform something called: Tarsorrhaphy. That's suturing the eyelid closed, in this case, after the eye has been eviscerated.

**Comment:**

what is it about their eyes that makes them look so 'wise'?

**Amanda Nicholson, WCV:**

Good question!

**Comment:**

Okay, owls move their heads in a circular motion for depth perception (if memory serves me right) so how does that work?

**Amanda Nicholson, WCV:**

Right! This sort of amazing movement is possible because they have twice as many vertebrae in their necks than we do. They also have some really amazing vascular adaptations as to not disrupt the blood flow when they're suddenly turning their head. Good article:

[http://www.hopkinsmedicine.org/news/media/releases/owl\\_mystery\\_unraveled\\_scientists\\_explain\\_how\\_bird\\_can\\_rotate\\_its\\_head\\_without\\_cutting\\_off\\_blood\\_supply\\_to\\_brain](http://www.hopkinsmedicine.org/news/media/releases/owl_mystery_unraveled_scientists_explain_how_bird_can_rotate_its_head_without_cutting_off_blood_supply_to_brain)

**Comment:**

Ms. Amanda, it seems to me that Ed indicated that many of the eagles hit by vehicles possibly had underlying issues and therefore had slower reaction times, thus the collisions with the vehicles. Is this also a reason why so many owls are hit by vehicles? Could their senses be diminished by food they have eaten, possibly poisoned critters or the such?



**Amanda Nicholson, WCV:**

Different sort of reaction. I'm thinking Ed probably mentioned eagles because there is some thought that those affected by lead toxicity (a big issue for eagles) may have slower reaction times.

**Amanda Nicholson, WCV:**

So sometimes we get those hit by car eagles in, find a high lead level, and suddenly the car collision is the secondary cause of admission ... we think first and foremost the issue was lead.

**Comment:**

Hey Amanda a quick Vulture question...this one seems to do a lot of u turns could it be the way the sun is shining into this enclosure and it seeing its shadow? Thanks

**Amanda Nicholson, WCV:**

I suppose it could be ... it seems to be able to maneuver really well!

**Comment:**

Thank you for your time this afternoon, Amanda :-)

**Amanda Nicholson, WCV:**

Well thank you guys!