2011 THROUGH 2014 BIRDS WITH MALFORMATIONS

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GENERAL DISCUSSION CONCERNING HATCHLING BIRDS WITH MALFORMATIONS.

Photos by Judy Hoy

The hatchling Northern Flicker in this photo was the only hatchling remaining alive when the parent flickers abandoned their nest with five young. It was brought to me for care on July 7, 2010. This hatchling flicker is one of several young and adult Northern Flickers observed or received with underdevelopment of the bone called the premaxilla, which is covered by the rhamphotheca. I am including it in this document of 2013 birds, to show that this has been a reoccurring developmental defect on hatchling flickers, especially in the last 5 years.

Every spring and summer, wildlife rehabbers in Western Montana receive hatchling and fledgling wild birds requiring care. Some young birds received each year since 1995 have had underdevelopment of the premaxilla and the rhamphotheca, which covers it. Some fledglings have disrupted development of their feathers and are rescued because they can't fly after fledgling. Rarely, we receive a hatchling with very

severely malformed legs and feet. Some of the species most often received with premaxilla underdevelopment are Northern Flicker, Mountain and Western Bluebird, American Robin, all species of swallow, Rock Pigeon and House Sparrow. The wildfire smoke in 2012 and 2013 appeared to contain especially toxic thyroid hormone disrupting chemicals. Most of the eggs laid by Rock Pigeon during the smoky periods in each of those two years, either failed to hatch because no embryo developed at all or the eggs had thin shells and broke. Of young pigeons that successfully hatched, about half had an underdeveloped premaxilla and rhamphotheca at the time of hatching.

From my experience as a wildlife rehabber, between 1995 and 2011 most hatchling birds with an underdeveloped upper bill were reported by the person who brought them to have been exposed to a recent known application of 2,4-D or 2-4,D mixed with other chemicals, such as Dicamba, MCPP or other organochlorine herbicides. In those cases, the malformations on hatchling or fledgling birds aren't what could actually be called congenital malformations. The affected birds usually have normal facial bone development when they first hatch. They do not experience the disrupted bone and/or feather growth until the period between hatching and fledging and such disruption of growth was only observed after exposure to a reported application of the herbicide or herbicide mixture occurred near the nest. Exposure to the herbicide application appeared to cause symptoms of chemical poisoning, including inability to digest food and consequent cessation of food begging for several hours. Both toxin exposure and malnutrition cause thyroid hormone disruption. Either or both likely result in disrupted calcium uptake by the cells and consequent disruption of the growth of the upper facial and upper bill bones, in addition to other symptoms of disrupted thyroid hormones.

Applications of the combination of 2,4-D and Picloram in the immediate area of hatchling birds with normal development and newborn domestic goats with normal development has in multiple occurrences resulted in the hatchling birds or in the baby goats having a fairly serious underbite within two days after the application occurred. Of course, if the birds or goats survive for more than two days the exposure continues for long after the initial application as the pesticides volatize in the sun and rain. Mortality has been observed with both birds and baby goats after application of 2-4,D and Picloram within a quarter mile of the affected animals.

Recent and interesting exceptions to the malformations occurring after hatching are the pigeon hatchlings and embryos found with brachygnathia superior in late summer of both 2012 and 2013. At that time in both years, there was a great deal of smoke from wildfires. The smoke was from here in Ravalli County and from Idaho in 2012. The smoke came from Idaho and California in 2013. Apparently, the exposure to toxins in the wildfire smoke resulted in the Rock Pigeons having disrupted development of the eggshell and disrupted growth of the upper facial bones during development in the egg. Consequently, the pigeon hatchlings had disrupted growth of the upper face and bills at the time of hatching.

Rehabbers in Western Montana now treat affected birds with supplements that enable bones with disrupted growth to resume growing. The bones grow to be normal

in size and configuration unless the bird dies from the exposure to whatever toxins caused the defect. This proves the malformation is epigenetic and not genetic in nature (**see page 4 for before and after treatment photos of a hatchling House Sparrow**). Hatchling birds that are not treated with electrolytes, which stimulate uptake by the cells of minerals vital to normal bone growth, do not grow to normal. Untreated birds retain the resultant underbite and/or crossed bills for the rest of their life as evidenced by photos often taken in the wild of adult birds with these malformations.

Epigenetics is the study of changes in gene activity that do not involve alterations to the genetic code. Epigenetic changes can be passed on for one or more generations. The new patterns of gene expression are regulated by cellular material called the epigenome. The prefix, epi-, means above. The epigenome sits on top of the genome and just outside of it. These epigenetic "marks" on the genome instruct the genes when to switch on or off and/or dictate the strength of the gene expression. Gene expression in young during their development is influenced by environmental factors such as nutrition, radiation, chemical exposure and diet of the mother. Epigenetic changes can be passed to the next generation or to several generations, but scientists who research epigenetics do not believe the DNA of the genes is affected. **Thus, epigenetic changes to individual organisms represent a biological response to an environmental factor or factors, but do not change the DNA of the organism.**

All cell types on one individual animal – brain cells, muscle cells, nerve cells, keratin cells, bone cells, etc., contain the exact same DNA. Epigenetic switches silence certain gene sequences and activate others, so that nascent cells can differentiate. If the switches do not work correctly, the cells may begin to continuously reproduce, resulting in cancer. Or premature cell death may occur, resulting in failure of organs to develop or function correctly, usually resulting in the death of the developing embryo or fetus. If an epigenetic switch simply switches off too soon, it can be stimulated to switch back on with supplements such as electrolytes and vitamins.

It takes only the addition of a methyl group consisting of one carbon atom attached to three hydrogen atoms to change an epigenome. When a methyl group attaches to a specific spot on a gene, it can change the gene's expression, turning it off or on, lessening its expression or increasing it. Results of such epigenetic changes to developing birds can range from devastatingly ugly such as fledgling birds with severely malformed legs (**see photo on page 26**), wings or faces to beautiful, white or partly white birds with leucism birders enjoy photographing (**see photo on page 27)**.

Besides the common upper facial bone and upper bill underdevelopment, we have gotten birds with crooked legs because one side of the bone grows faster than the other side (also seen on mammals) or with broken legs due to stress fractures. Some heavier fledglings often have multiple fractures on one or both legs. Another fairly common malformation on fledgling birds is disruption of the primary and secondary wing feathers or tail feathers, or both. Occasionally we get a bird on which all feathers on the body fail to grow leaving the fledgling nearly bare. Some hatchlings have severe respiratory problems or have neurological problems in wings or legs or both, usually related to known pesticide applications in the area where the nest was located.

This is a hatchling House Sparrow received June 4, 2011 with brachygnathia superior/ underdeveloped upper facial bones.

This is the same hatchling House Sparrow one week later after it had been treated with electrolytes that stimulate mineral uptake by the cells. The face and bill had grown to be completely normal in size and shape.

The hatchling House Sparrow was brought to me from Lolo, MT, for rehabilitation on June 4, 2011. This hatchling was found on the ground beside a house. The lawn had been sprayed with herbicides two days prior to the house owner finding the hatchling sparrow. Since it was still a hatchling and not a full-grown fledgling, the upper bill grew to normal in two days after treatment by mixing Calc. Phos. 30X and Bioplasma with the baby bird food formula at three-hour intervals. Baby birds have to be fed every 20 minutes. This bird recovered completely and was released when it was old enough.

On the same hatchling House Sparrow (bottom photo on **page 4),** six days after I received it for care, the premaxilla and rhamphotheca are completely normal in length. Note that the normal upper bill is slightly longer than the lower bill. Also, the lower bill fits neatly inside of the edges and tip of the upper bill as is normal for a member of the finch family and many other bird species.

The medical term for an underdeveloped premaxilla on birds or premaxillary bone on mammals is brachygnathia superior. The prevalence on hatchling birds is unknown. It is difficult to impossible to know how many hatchlings in each nest of wild bird species have brachygnathia superior. Sometimes all of the hatchlings brought for rehab have an underbite and sometimes one or two of several hatchlings has an underbite. The hatchlings are not brought to us because of the underbite.

I and other rehabbers have collectively helped dozens of hatchlings with underbite or crooked legs of many species of bird to grow to normal by giving the two homeopathic cell salt tablets. This proves that brachygnathia superior as a result of underdeveloped premaxilla on hatchling birds is an epigenetic change during development and not caused by damaged genes. If their genes dictated their upper bill to be shorter than the lower bill, it would not be possible to cause the premaxilla and rhamphotheca to grow to normal with an electrolyte supplement. Putting the cell salts in their milk formula similarly treats all newborn mammals with brachygnathia superior brought for rehab. Other than birds, rehabbers have thus far treated mostly wild and domestic ruminants for brachygnathia superior.

One American Crow hatchling was received in July of 2013, which had multiple stress fractures in both legs because the long bones in the legs failed to change from cartilage to bone when they should have. This is a very common developmental defect in New York State and fairly common here in Montana. The rehabilitation centers there have to euthanize most young crows with disrupted development of the leg bones because they are never able to stand, walk or fly. Reference for study of New York American Crows; Basil P. Tangredi and Lennart P. Krook, Nutritional Secondary Hyperparathyroidism in Free-Living Fledgling American Crows (Corvus brachyrhynchos brachyrhynchos), *Journal of Zoo and Wildlife Medicine,* Vol. 30, No. 1 (Mar., 1999), pp. 94-99.

2011 AND 2012 BIRDS WITH UNDERDEVELOPED PREMAXILLA AND RHAMPHOTHECA.

Since spring of 1995, hatchling birds have been observed in increasing numbers with disrupted development of the upper facial bones, especially the premaxilla (bone of the upper bill) underlying the rhamphotheca (keratin covering the bills) as illustrated by the fledgling House Sparrow in this photo. This House Sparrow was found on the ground in July of 2011 and was brought to me for rehabilitation. Since it was already a fledgling and fully grown it was too late to cause the premaxilla and rhamphotheca to grow to normal

This is an adult male House Sparrow, which as a hatchling had an underbite very similar in severity to the young House Sparrows shown in photos on page 1 and 2. It was found dead in January of 2012. This bird of course did not receive treatment as a hatchling since it grew up in the wild. Its upper bill obviously did not grow to normal without treatment and so it had an underdeveloped upper bill for life. Both bills have abnormal rhamphotheca development resulting in the lower bill being somewhat misshapen. Whether the slight underbite and abnormal rhamphotheca contributed to its death in the winter during cold weather, is not known, but the bird was emaciated. It may have also had an illness that caused its death.

This is a Rock Pigeon embryo from an egg that failed to hatch in summer of 2011. This pigeon embryo has slight underbite. Brachygnathia superior/underbite has increased significantly on hatchlings of Rock Pigeons since 2007, especially in the summers when there is smoke in the air from wildfires. In both summers of 2012 and 2013, there was a month or more of very smoky air conditions as a result of wildfires in California and Idaho. Smoke from Idaho was quite heavy, especially in 2013, when it mixed with smoke from local forest fires. Very few pigeons hatched when the air was smoky and at least half of those that did hatch had brachygnathia superior and trouble breathing. Most died prior to fledgling. Many of the unsuccessful pigeon eggs had very thin shells that broke easily. After the fires were out and there was no longer smoke in the air, the eggshells were again normal in thickness and the hatchlings no longer had brachygnathia superior when they hatched.

TWO ADDITIONAL BIRDS WITH BRACHYGNATHIA SUPERIOR FROM 2011.

A fledgling European Collared Dove, which was brought for rehabilitation in spring 2011 had only a slight underbite.

An Evening Grosbeak adult male was photographed by Eugene Beckes near Ronan, MT in winter of 2011.

HOUSE SPARROW HATCHLINGS WITH BRACHYGNATHIA SUPERIOR RECEIVED PRIOR TO 2011.

These sibling hatchling House Sparrows were found near Stevensville, Montana in June 2009. They fell from the eves of a house onto the lawn, where they were found and brought for rehab, but both died soon after arrival. Both hatchlings had an obvious underdeveloped premaxilla and thus brachygnathia superior. This suggests House Sparrows are being affected by a hormone disrupting agent. Certain herbicides applied to the lawns near the nests and where the parent birds collect insects to feed the young have been found to be thyroid hormone disrupting, especially 2,4-D and any combination of herbicides with 2,4-D in the mixture. Organochlorine herbicides appear to be quite thyroid hormone disrupting to both birds and mammals.

Another hatchling House Sparrow that was found dead with live siblings in a nest in a trailer that had to be moved, the reason the hatchlings were brought for rehab. I asked for the dead one to be brought to me also. This sparrow was hatched in 2008, but is included to show the affects of thyroid hormone disruption was observed on House Sparrows prior to 2011. House Sparrows in London, UK, have declined a great deal in the last 15 years. A reward was offered for information as to what might be causing their decline. The House Sparrows began their significant decline in London immediately after huge amounts of fungicides began being applied to the potato fields in northeastern U.K. for potato blight in 1994, directly upwind of London. When lawn herbicides that are thyroid hormone disrupting are combined with exposure to thyroid hormone disrupting fungicides used on the potatoes, the result appears to be birth defects in hatchling birds of multiple species, especially those living near herbicide sprayed lawns or fields.

MANDIBULAR BRACHYGNATHIA – OVERBITE – UNDERDEVELOPED LOWER JAW ON A 2011 HOUSE SPARROW.

This fledgling House Sparrow was brought for rehabilitation in 2011. It had the only overbite I have seen on a bird and it was quite severe. It appears that House Sparrows are quite severely affected by thyroid hormone disrupting environmental factors, likely because they live in the eves of houses, in holes in trees or in birdhouses near where pesticides are commonly used. Rock Pigeons and House Sparrows are two of the species most often observed with facial bone underdevelopment.

There are two more photos of this same House Sparrow on page 9 showing the overbite from different angles. House Sparrows appear to be particularly susceptible to whatever is causing the facial malformations on avian species.

2012 BIRDS WITH DISRUPED BILL DEVELOPMENT/BRACHYGNATHIA SUPERIOR.

Three hatchling American Robins from one nest were brought to me on July 26, 2012. All had yellow skin. Two died before arrival. The middle one survived. It did not have brachygnathia superior and skin was not as yellow as its siblings. The birds were found after the nest fell down from a beam on which it was built. The next door neighbors of the people who owned the garage where the nest was built had sprayed their lawn several times with unknown pesticides. The parent American Robins caught insects and worms from the neighbor's sprayed lawn and of course the birds were also exposed to the pesticides in the air.

This hatchling robin died before arrival. Note very yellow skin indicating liver damage.

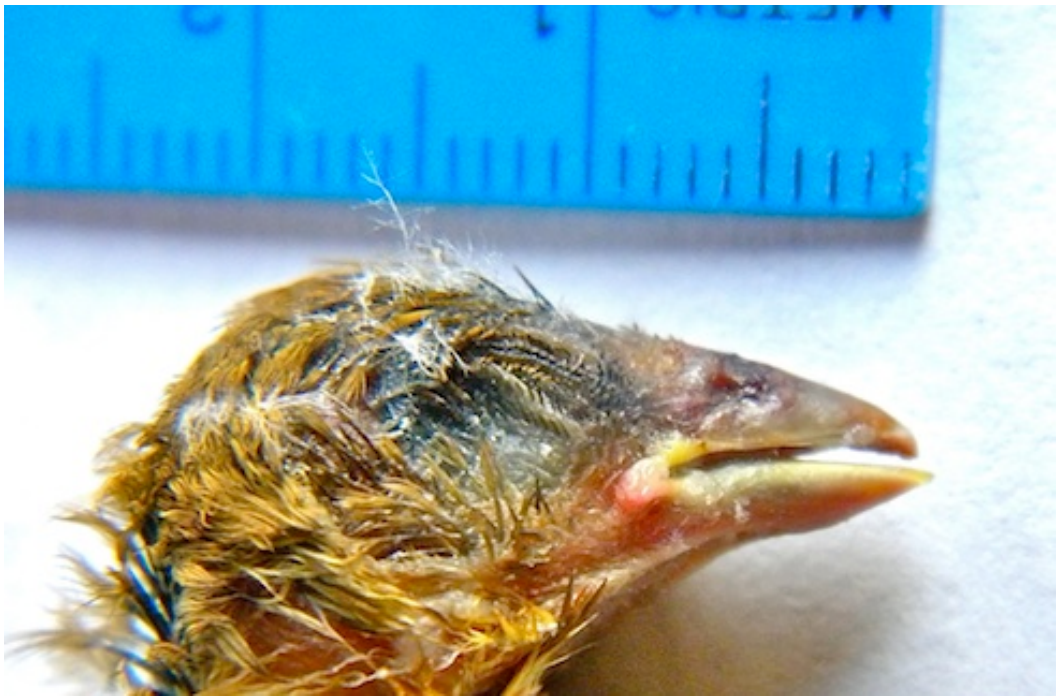
This is a close-up of the head of the above robin hatchling showing quite severely underdeveloped upper facial bones (brachygnathia superior) with short upper bill and very yellow skin.

This hatchling robin died from the fall. It also had yellow skin indicating liver damage.

This is a close-up of the head of the above robin hatchling showing underdeveloped upper facial bones (brachygnathia superior) with short upper bill and yellow skin, similar to its sibling.

The middle hatchling robin in the first photo was still alive, had just slightly underdeveloped upper bill so the bills were even, rather than the upper bill being slightly longer as is normal. This robin had slightly yellow skin on arrival. This photo is of the surviving robin as a fledgling prior to release. Note the upper bill was normal in length, with the upper bill slightly longer than the lower bill. The fledgling had recovered from the liver damage and was completely healthy when it was released. Upon arrival, it was treated to mitigate liver damage from chemical poisoning with both electrolytes and vitamins.

An American Goldfinch fledgling brought for rehab had symptoms of exposure to lawn herbicides, including; disrupted feather growth, respiratory distress, lethargic, unable to digest food, and brachygnathia superior (underdeveloped upper bill).



This is a close-up of the underdeveloped upper bill after the Goldfinch fledgling died of respiratory problems. It fell from a nest near a street in Anaconda, MT where the lawns all appeared to have been treated with herbicides, according to the rescuer who brought the bird to me.

This pre-fledgling Rock Pigeon with severe brachygnathia superior was found dead August 22, 2012.

Another pre-fledgling Rock Pigeon with moderate brachygnathia superior and odd shaped upper and lower bills was found dead on August 29, 2012. The wildfire smoke was very thick from the end of July through August and into September.

2011-2012 BIRDS WITH DISRUPTED KERITAN DEVELOPMENT.

A Great Horned Owl was brought for rehab in 2011 because it was emaciated as a post-fledgling. This immature Great Horned Owl's tail had one feather grown in upside down. Disruption of the growth of the rhamphotheca of the bills or of the feathers or the keratin of the legs and feet is called Disrupted Keratin Disorder by USGS researchers.

WILD TURKEY WITH DISRUPTED FEATHER DEVELOPMENT.

This is a fledgling Wild Turkey that was brought for rehab from near Corvallis, MT in August of 2012. It had underdeveloped and malformed primary wing feathers. Many of the primary and secondary wing feathers were short and some were growing in the wrong direction. Many of the wing feathers were also not the correct color. This disruption of the melanin to the developing feathers is called leucism. This is also an epigenetic change during development of the young bird, as is disrupted feather growth. Because this bird was unable to fly, it was caught by a dog and fatally injured. To summarize, the wing feathers, especially the primary feathers on this fledgling Wild Turkey were underdeveloped, abnormally shaped and many were unusual in color.

These are photos of the right and left wings of the fledgling turkey showing the underdeveloped, odd shaped and odd colored wing feathers.

OSPREY FLEDGLING WITH DISRUPTED FEATHER DEVELOPMENT.

These two photos show the malformed feathers on the head and neck of a fledgling Osprey from a nest at Lee Metcalf National Wildlife Refuge in August of 2012.

These two photos show the malformed, narrow and damaged primary feathers from the right wing above and the left wing below.

The damaged tail feathers of the same fledgling Osprey chick caused by disrupted feather development on all the tail feathers. The chick had blood taken to test for the amount of mercury present. I never received the results. Other chicks tested for mercury from the Lee Metcalf National Wildlife Refuge have tested fairly high for mercury. If the chick was exposed both to mercury and to the toxins in the smoke, which is likely, the damage would be greater than one factor alone.

2013 BIRDS WITH DEVELOPMENTAL MALFORMATIONS.

This photo shows the very malformed legs and feet of a fledgling Violet Green Swallow. It came from a nest near Frenchtown, MT on July 15, 2013. This was the only young bird received for care in 2013 with such severe disruption of the leg bones.

I have reported the malformations rehabbers and birders observe on birds each year to the USFWS, to the MDFWP, to the University of Montana Ornithology Department, to the USFWS Laboratory in Madison, WI, to the Falcon Research Group and to many other people who claimed to be interested in birds and problems in bird populations. Colleen Handel is researching bill malformations on Alaskan birds. Ornithologists at UM, and a chemist at UM work together to test the blood on birds for lead and other metals. The USFWS in Denver and the MDFWP have not shown concern for malformations in Montana avian species and neither responded to my reports of multiple individual birds of multiple species having developmental malformations

This leucistic fledgling European Starling was brought to me for care in spring 2013. No melanin had gone into the feathers to produce normal colored feathers, resulting in all the feathers being white. The bill tip was yellow and the eye was normal dark brown. Most leucistic birds have a few to many, but not all feathers affected, thus some of the feathers retain normal coloring. Quite a number of individual birds of many species have been observed with leucism since 2007 and observant bird watchers have photographed many of them.

This is a photo of a hatchling Northern Flicker with normal development of the premaxilla and rhamphotheca. It was one of five hatchling flickers received for care on June 14, 2013 when the nest tree blew down in a windstorm. Three hatchlings had normal bone and bill development like the hatchling in the above photo. Two had underbite like the hatchling in the photo below. One of the hatchlings with underbite had breathing problems, possibly from being hurt when the tree fell. It died after two days. The other four flickers were successfully raised and released. Two were males and two were females.

This sibling of the normal flicker hatchling shown in the above photo has an underdeveloped premaxilla and rhamphotheca, resulting in the upper bill being shorter than the lower bill/brachygnathia superior. The bill grew to be normal after two days of treatment with the mineral electrolyte supplement. Its face and bill was completely normal when released with its three surviving siblings.

ROCK PIGEON HATCHLINGS AND FOREST FIRE SMOKE.

The summer of 2012 and summer of 2013, there was a month or more of very smoky air conditions, as a result of wildfires in California and especially Idaho, as well as local forest fires. Very few pigeons hatched when the air was smoky and at least half of those that did hatch had brachygnathia superior and trouble breathing. Most died prior to fledgling. Many of the unsuccessful pigeon eggs had very thin shells and broke easily. After the fires were out and there was no longer smoke in the air, the eggshells were normal in thickness and did not break prior to hatching.

This hatchling Rock Pigeon had a crossed bill because the left side of the premaxilla and the tip of the rhamphotheca did not grow normally. This hatchling found on June 21, 2013 died despite my best efforts to save it. When the bill is crooked and malformed like this individual, rehabbers can't achieve normal growth with electrolyte supplements. The next page shows two more views of this unusual bill malformation.

This fledgling pigeon was found dead on June 15, 2013.
It has a quite severely underdeveloped premaxilla and was unable to close its mouth completely.

This fledgling pigeon was found dead on August 28, 2013. Like the pigeon above, it has fairly severe brachygnathia superior and could not close its mouth.

A somewhat decomposed dead Rock Pigeon fledgling was found at our place on September 14, 2013. Like the fledgling Rock Pigeons in the previous photos, this bird had obvious brachygnathia superior, likely resulting in being unable to eat after fledging.

Immediately after the fires were out in fall of 2013 and there was no longer smoke in the air, all the Rock Pigeon eggshells were normal in thickness and most of the eggs produced hatchlings. No hatchling had brachygnathia superior or other developmental malformation for the remainder of 2013.

BIRDS OBSERVED IN THE WILD WITH BRACHYGNATHIA SUPERIOR.

PHOTOGRAPHED IN THE WILD BY JIM GREAVES AT THOMPSON FALLS, MT AND BY EUGENE BECKES AT ST. IGNITIUS, MT.

During the summer and fall of 2013, Jim Greaves, a wildlife photographer, who lives in Thompson Falls, MT photographed several birds with disrupted development of the upper bill and/or crossed bills. The crossed bill effect is the result of more severe underdevelopment of one side of the premaxilla under the rhamphotheca, resulting in the bone angling towards that side. The right side of the upper bill is most often underdeveloped, thus the upper bill more often grows to the right than to the left. The lower bill is usually straight forward, but is fairly often overgrown because it does not receive normal wear. With crossed bills, the rhamphotheca of both bills can become overgrown.

This juvenile Spotted Towhee is an example of the right side of the upper bill being underdeveloped, resulting in the crossed bill effect. The next two photos are close-up photos of the same Spotted Towhee. This bird hatched in July of 2013.


Spotted Towhee juv - cross-billed
Thompson Falls MT - 21 Aug 2013
Jim Greaves photo


Spotted Towhee juv - cross-billed
Thompson Falls MT - 21 Aug 2013
Jim Greaves photo

Another juvenile bird, a Western Tanager hatched in the Thompson Falls area in 2013 with disrupted development of the upper bill. This was one of three fledglings. The other two had normal bills.

To prove that the underdeveloped upper bill defect is widespread, this photo of a Chestnut-backed Chickadee (a non-migratory bird) with very underdeveloped upper bill was taken in Goleta, CA by J. Greaves in 2006.

This juvenile American Robin with underdeveloped, excessively curved upper bill also hatched and grew up in the Thompson Falls area in July 2013. Jim Greaves photographed the young bird foraging in his yard. Note the large normal left eye, as opposed to the underdeveloped right eye, which was blind (photo on page 16).

This appears to be the same American Robin photographed again on 11-05-2013 in Thompson Falls by J. Greaves, as the bill is the same. The right eye appears to be very small and the eye itself was not developed, causing blindness in the right eye. The left eye was normal (see photo on page 15).

This is a Brewer's Sparrow with a slightly crossed bill. The left side of this bird's premaxilla under the rhamphotheca was slightly underdeveloped resulting in the premaxilla and rhamphotheca of the upper bill angling slightly to the left. J. Greaves photographed it in Thompson Falls, August 18, 2013.

Eugene Beckes photographed this Common Redpoll near St. Ignitius, MT on 2-13-2013. It has straight bills, but the premaxilla and rhamphotheca of the upper bill is fairly severely underdeveloped.

This adult Dark-eyed Junco, photographed by E. Beckes near St. Ignitius, MT on 4-23-2013, is another example of straight bills with underdevelopment of the upper bill.

Birds that live year around in the Flathead Valley appear to be quite often affected by something that causes the epigenetic changes to the development of the bone or bones of the upper face and upper bill. A lot of different species, including birds and mammals have been photographed by Eugene Beckes on the National Bison Range and near St. Ignitius that show obvious underbite/brachygnathia superior and some birds with crossed bills. However, the Chestnut-backed Chickadee Jim Greaves photographed in California in 2006 (photo on page 14) had a worse underbite than the Chestnut-backed Chickadee, photographed by Eugene Beckes near St. Ignitius in 2013 (photo on page 21).

A Mountain Chickadee photographed near St. Ignitius, MT by E. Beckes on 2-25-2013 with slight brachygnathia superior.

A Chestnut-backed Chickadee photographed by Eugene Beckes on January 24, 2013 near St. Ignitius, which has slight brachygnathia superior/underdeveloped upper bill and facial bones.

This Mountain Chickadee was photographed by E. Beckes on October 29, 2013 in the same area as above Chestnut-backed Chickadee. The bird appeared to be unable to open the toes on the right foot.

Underdeveloped upper bill, with an angle to the right, on an adult female Hairy Woodpecker photographed by E. Beckes near St. Ignitius, MT on 2-13-2013. Note that the upper bill is thin at the base of the rhamphotheca and the lower bill has become somewhat overgrown along the top edge on the left side because it does not receive normal wear with the upper bill angled to the right.

This is a front view of the same adult female Hairy Woodpecker showing the bill angling to the right. It is likely that the premaxilla underlying the rhamphotheca of the upper bill was more underdeveloped on the right side resulting in the upper bill angling to the right.

A Golden Crowned Kinglet with crossed bills was photographed by Eugene Beckes near St. Ignitius, MT on December 25, 2013. Again the upper bill angles to the right, but the upper bill is normal in length, with the upper bill slightly longer than the lower bill. This is fairly unusual. On birds with crossed bills, the upper bill is usually shorter than the normal length lower bill.

A female Varied Thrush photographed in Thompson Falls, MT on March 2014 by Jim Greaves. This Varied Thrush has a crossed bill because the left side of the upper bill is underdeveloped at the base of the bill. The upper bill does not appear to be shorter than the lower bill, but appears to be underdeveloped and thinner than a normal thrush upper bill. There appears to be some abnormal overgrowth of the bill tips because of the crossed bills.

This male House Sparrow has a very large overgrown upper bill. Dan and Wendy Pleier photographed this sparrow in Hardin, MT by on March 11, 2014. This type of bill malformation was named Avian Keratin Disorder (AKD) by the USGS bird researchers who are working to find why there are so many birds in Alaska with this bill malformation. AKD can occur suddenly on an adult bird and has been documented on many species. Something stimulates the rhamphotheca (keratin covering of the bills) of such birds to suddenly begin growing much faster than normal. The rhamphotheca of the bill/s continue to grow very fast This is not a developmental malformation. There is a close-up photo of the head and bill of the same bird on **page 50**.

This is another photo of the same male House Sparrow showing a better view of the wide odd shaped overgrown upper bill. Photo was taken by Dan Pleier.

AKD can occur suddenly on an adult bird and has been documented on many species. The rhamphotheca at the tips of the bills of most birds normally grows very slowly to replace normal wear. Something stimulates the rhamphotheca (keratin covering of the bills) of birds with AKD to suddenly begin growing much faster than normal. The rhamphotheca of one or both bills continues to grow very fast for several days to several weeks and then returns to normal growth. Some bird species, especially crossbills have sudden fast growth of the bill tips soon after fledgling. Certain hormones, especially sex hormones, which stimulate the pituitary gland to produce growth hormones, cause that sudden fast growth to the tips of the bills. It is likely that exposure to some type of hormone disrupting toxin is responsible for the abnormal sudden growth expressed on birds with AKD.