In search of the Nearctic juvenile 'Hare-footed hawk '- the real cinnamon challenge!

A focus on juvenile light/pale morph Rough-legged Hawk (*Buteo lagopus sanctijohannis*) identification

*(**Fig. 1**) Rough-legged Hawk lithograph, John James Audubon and Roe Lockwood, 1870-1871*

1. Introduction

All western European birders as terrestrial beings marvel at trans-Atlantic vagrancy and I for one think oceanic crossing by any avian species is simply beyond words.

This wonderment has only intensified having worked in a professional capacity studying satellite-tagged Hen Harriers (*Circus cyaneus*) for the past seven years and watched the world shrink before my very eyes. This revolutionary technology (that has thrown theories on their head) has given me a newfound respect and outlook on raptor vagrancy.

In a western European context, unless you're a Greenlandic Gyr falcon (*Falco rusticolus*), an Osprey (*Pandion halieatus*) and, to a certain degree, White-tailed Eagle (*Haliaeetus albicilla)*, most raptors find a pelagic environment beyond alien, not only because of the environmental pressures, but also active harassment from everyone and everything. Personally, as a raptor fanatic, I'm fascinated about species that push the confines of what hominids perceive as normal or unachievable.

Anyone who has ever witnessed a migrating raptor come in off the sea will agree that is one of the rawest and most awe-inspiring experiences out there! Not only because living is easy for us, but only when you bear witness to a moment of raw battle of life and death do you begin to feel alive yourself.

I spend many an evening daydreaming at the thought of migrant raptors shifting with the necessity to survive. Anyone who has turned a leaf in 'Raptors in Focus' by Dick Forsman (Forsman, 2016) knows exactly what I'm talking about.

*(**Fig. 2**) Steppe Buzzard (Buteo b vulpinus) by Dick Forsman.*

Each page decorated right up to each and every corner with a snapshot of a bird trying to survive in a world abundant in peril.

What is it that draws us to this as birders? Well for me it's the reminder we live in a shared world of trials and tribulations, rather than a world where animalia live to serve man.

My last in-depth observational study was focused on the adult plumage of female Northern Harrier (*Circus hudsonius*) https://raptor-id.blogspot.com/2017/04/identification-of-adult-female-northern.html As it happens, whilst I write this, a 2nd calendar year female has recently resided in Ireland, having been re-found in its 1st adult plumage (within its second winter), having been found as an immaculate juvenile the winter before. This is a species that now makes an annual pilgrimage to European shores - just MAGIC!

Again, I find myself casting my view to the west in search of yet more cinnamon Nearctic hues. Not quite as gingery as the re-elected US president's face, Monarch Butterflies (*Danaus Plexippus*) or pristine juvenile Northern Harriers, but slightly more muted!

Here I will be exploring the subtle differences between juvenile light/pale morph Rough-legged Hawk (*Buteo lagopus sanctijohannis*) (hereafter L/P RLH) from the nominate monotypic light/pale morph Rough-legged Buzzard (*Buteo lagopus lagopus)* (hereafter RLB).

I'm going to 'attempt' to observe some subtle differences in their plumages to see if we can shed a little more light on them, in the context of European field ornithology, away from the unique vagrant juvenile dark morph birds that likeminded folk have already visited.

Essentially the following are musings about possible identification criteria and thoughts on vagrancy, hopefully to bolster the work already touched on by a few of my contemporaries (raptor research is most definitely a team game).

Josh Jones did yet another fascinating piece regarding vagrancy of this species and their Western Palearctic records to date. His work amalgamated his personal research and his encounters in the field with the studies the late Martin Garner explored, about potential '*sanctjohannis*' plumage characteristics. Please visit the following link to see more ideas and stunning juvenile RLHawks of all flavours -

https://www.birdguides.com/articles/a-rough-legged-hawk-on-corvo-azores-october-2013

Having had the privilege to work alongside the Rough-legged Hawk Project team in Quebec in Eastern Canada in recent months, I've spent many a special hour discussing, trapping and satellite-tagging this spellbinding subspecies for their ongoing fieldwork studies. Having been in the presence of their abundant knowledge regarding the Rough-legged Hawk and looked at this subspecies through their lens, I've realised my work is simply scratching the surface with regards to juvenile racial ID and there is a load more fascinating stuff to come from them and to collectively explore.

The team also made me aware of the incredible work compiled by Tom J. Cade (Variation of the Common Rough-Legged Hawk in North America. The Condor, 57(6), 313–346. https://doi.org/10.2307/1364791) in 1955, where he visited the characterisation of the Rough-legged clade, a long time before the internet and instant communication networks with other raptor fellows was like it is today. Truly inspirational stuff and work I hope to support, with shared ideas we independently reached.

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2. Subspecies Classification

A good starting point to this clade is the following work compiled by the British Bird Rarity Committee (BBRC), which provides a great outline for the current classification of the natural group of what we know as 'Rough-legs' or 'Roughies' and is worth absorbing, to understand why I'm looking west, rather than looking towards the pale beasts from the east!

From the brief flings I've had with the far eastern RLB specimens and pics I've studied, I'm pretty sure any birder would get instant brain freeze on locking eyes with one of these feathered yetis skirting the breakers and making landfall, unlike the subtle tortoiseshell tones of their Nearctic counterparts. I do aim to revisit the 'beasts from the east' at a later stage and pick up where Tom Cade's initial studies left off, with a bird Graham Catley and I have discussed together. This bird under examination had some beautifully subtle cold plumage tones and not dissimilar pseudo-yeti vibes to very faded first 2nd calendar year birds or young L/P RLH from the Northwest of the Nearctic Realm.

Per BBRC (British Birds Rarity Committee) - Nominate lagopus breeds across northern Europe and Asia but is replaced in north-east Asia by *menzbieri* and in Kamchatka by *kamtschatkensis*. The subspecies *sanctijohannis* ('Rough-legged Hawk') breeds across northern North America. The

Palearctic subspecies occur in a pale form only but *sanctijohannis* is dimorphic, occurring in a pale form '**similar'** to Palearctic birds and a less common dark form.

Nominate lagopus is a scarce winter visitor to Britain.

'Rough-legged Hawk' is not yet on the British List (currently in circulation), but it is a potential vagrant and occurrences here have been suspected (Millington, 2001); refer to Josh's link above for vagrancy.

There are confirmed records involving dark morph birds from Iceland, the Faeroes, the Azores and Ireland where a number of pale morph birds have also been seen on dates and in weather circumstances highly suggestive of a Nearctic origin (Jensen 2002, 2003, 2006, Mullarney & Murphy 2005).

http://www.irbc.ie/reports/irbr/2005_IRBR.pdf

BBRC go on to add – 'The firm identification of pale morph *sanctijohannis* rests on biometrics. Dark morph birds, however, are more striking although they would need to be distinguished from other wild or escaped dark morph Buteos e.g. 'Steppe Buzzard' *B. b. vulpinus* and Long-legged Buzzard *B. rufinus*. Claims of dark morph *sanctijohannis* should include detailed notes and photographs. Claims of pale morph *sanctijohannis* should also include biometrics or details from a ringed or marked bird. Date and location might provide circumstantial supporting evidence.' (Updated Dec 2017 AMS).

Although I absolutely encourage and support BBRC's sentiments with regards to collecting biometrics from any putative *sanctijohannis* specimens, following personal communication with the Rough-legged Hawk Project team and reviewing what info is available online, I would exercise great caution with biometric data to assign a bird to race, given the clinal biometric overlap observed in the Rough-legged taxa, even within *sanctijohannis* itself, along their own clinal range.

Amazingly and on topic it has come to light whilst in the process of compiling these notes that Bob Bosisto et al discovered an early vagrant Rough-legged Buzzard on the 13th of October 2019 that was taken into care and duly succumbed to its exhaustive journey. Examination of the specimen and DNA analysis by the Martin Collison and team showed the bird was most likely of Nearctic origin…sound the klaxon!!!

A potential 'Rough-legged Hawk' in Cornwall. Bosisto et al. / July 2021 – vol. 114, issue 7, pp 422–424

https://britishbirds.co.uk/content/potential-%E2%80%98rough-legged-hawk%E2%80%99-cornwall

I was very kindly sent the pictures to study by the observers and will have a look at this bird in detail later to explore whether this bird (a proven vagrant of Nearctic origin) fits my thoughts and makes for a good litmus test, as to how worthy my notes are for field study. Also, whether these musings may help shed light on field ID away from bio or morphometrics that are only really possible with a dead, moribund bird or through trapping birds to conduct satellite tagging or ringing studies, as shown by the work done by the Rough-legged Hawk Project.

Before we visit that unfortunate Cornish bird let's refer to Josh Jones' article, in which he touches on Gloger's rule, whereby David Sibley states there are c25-40% dark morph and 60-75% light morph *sanctijohannis* in the east of North America. (Sibley (2014), quoted in Jones, A Rough-legged Hawk

on Corvo, Azores, Birdguides Article, October 2013). This is an ecogeographical rule which states that within a species of endotherms, more heavily pigmented forms tend to be found in more humid environments. A theory that is also pushed by Brain Wheeler who states that 'dark morphs tend to breed in the more humid moist areas in N. Quebec. The breeding population in Newfoundland has a small percentage of dark morphs but a light gene flow is more common than up in the north Northeast' (Wheeler, Brian K. (2003) Raptors of eastern North America).

As a side and on the point of phenotypes, interestingly the pics I've seen of birds from B. Columbia and Alaska are far more RLB looking and seem to have more cursory Long-legged buzzard (*Buteo rufinus*) vibes akin to some *menzbieri* types. This is most likely owing to their colder and drier, rather than a humid climate, that has directly influenced their plumage tones and more than likely resulting from less bacterial load in their environment that can and would hamper their feather condition.

This is something Tom Clade has reviewed and discussed and is currently being explored by the Rough-legged Hawk Project team, having worked tirelessly to sample RLH across the length and breadth of North America.

I have also pondered with the idea whether phenotypic variation between Nearctic and European juveniles to some degree is influenced by the geology or floristics across the Arctic range, with adaptations that prevent detection and/or recognition of nestlings, as an anti-predation strategy whilst they develop in the nest. This would equally assist them on their return as first-time nesters with an inexperienced female incubating/nest building.

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3. Vagrancy across the North Atlantic

I feel the vagrancy potential of juveniles of this species to UK shores are driven by a complex inter-connected combination of events, an almost perfect storm if you will. This is on reflection of a paucity of facts, given the wide range of this species across the Nearctic and the origin of the Atlantic drifters. Hopefully the great pioneering work by Jeff Kidd and Neil Paprocki, plus all the volunteers and taggers within The Rough-legged Hawk Project, will soon cast further light on RLH migration in eastern Canada, following the deployment of yet more satellite tags on adults and juveniles. This may hopefully give us all a better idea of post-juvenile dispersal and how these birds utilise the migratory routes in this eastern flyway in this huge and relatively hard to research zone. Better still, it may even give us some closure, with a tagged bird wandering well west and taking a route folks have modelled.

As it stands the project has tagged three Bylot Island (Baffin Bay) birds, which are the north-eastern most for the study; these birds wintered near Toronto and all the other 2nd calendar year + birds wintered in western US.

The eastern most purple route (shown in the **figure 3** below) was taken by a returning L/P morph adult female in the attached map supplied by Neil Paprocki (Rough-legged Hawk Project). Neil mentions it is likely that many eastern RLH take this route. Neil very kindly allowed me to join and his team to deploy a further ten satellite tags in Quebec. Hopefully time will tell where these eastern Nordic nomads will come and go and by which routes.

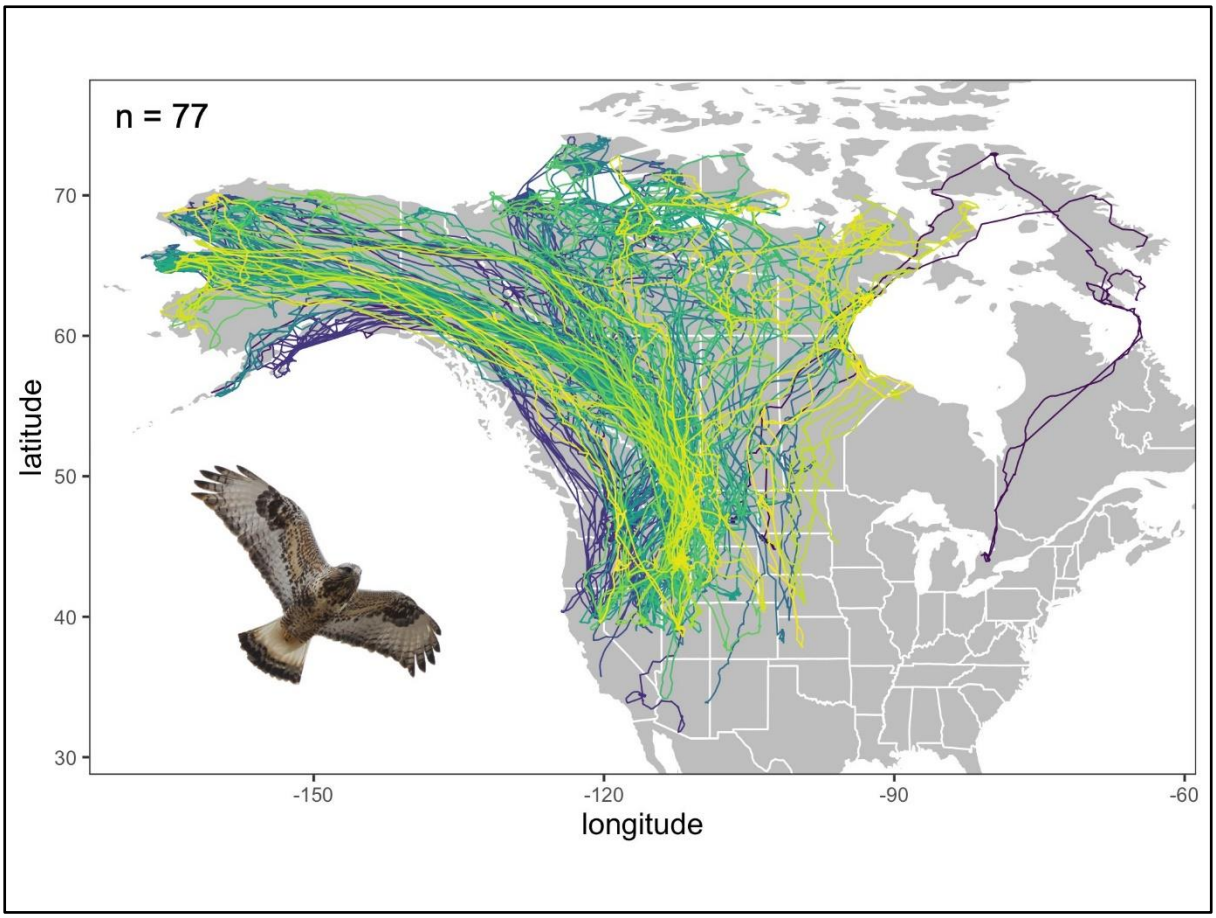


Fig. 3

In the meantime, from what I have read and observed, I think we need to focus on the southeastern end of the northwest passage, where Canada runs parallel to Greenland. This is where I suspect some of our vagrants undoubtably originate and/or get bottlenecked, as in Josh's article.

One would imagine the feasibility that juveniles fledging a nest from the Elsmere population, Baffin Islands, Hudson Bay, Hudson Straight, Baffin Bay, Bylot island and as high as Prince Patrick Island (Parry Islands) amongst others, would migrate along the eastern seaboard of North America. With a strong westerly airflow, you can imagine some would drift into Greenland and into Iceland, Faroes and on into Ireland and the UK.

This is reinforced by the historic occurrence of a pale morph RLH that came aboard a Faeroese trawler off the west coast of Greenland at 64.30°N, 53.05°W in 2001 and in 2017/18, whereby an observer photographed a Rough-Legged Hawk on the coast of western Greenland while on a cruise to/from Nunavut.

Even more Greenlandic records have come to the surface after discussions with David Boertmann, a senior research biologist of department of eco science, Arctic environment section at Arhus University. David Boertmann very kindly shared the status and records of 'Rough-legged' records he has compiled for his checklist of birds of Greenland of which all the photographed individuals have been the Nearctic ssp. *sanctijohannis* (J.F. Gmelin 1788).

STATUS: Rare vagrant to West Greenland with eight autumn records, with the most recent in 2017.

West Greenland:

Qaqortoq/Julianehåb: 55 km southwest of Nunap Isua/Kap Farvel, 25 Sep 2002 landed on trawler SOURCE unknown.

Paamiut/Frederikshåb: Paamiut town, 25 Sep 2008 (B. Knudsen in litt.). —

Sisimiut/Holsteinsborg: Offshore at 66,55° N, 55,18° W, 30 Sep 1999. 1y (?) (Boertmann & Møller 2000, RC 1999).

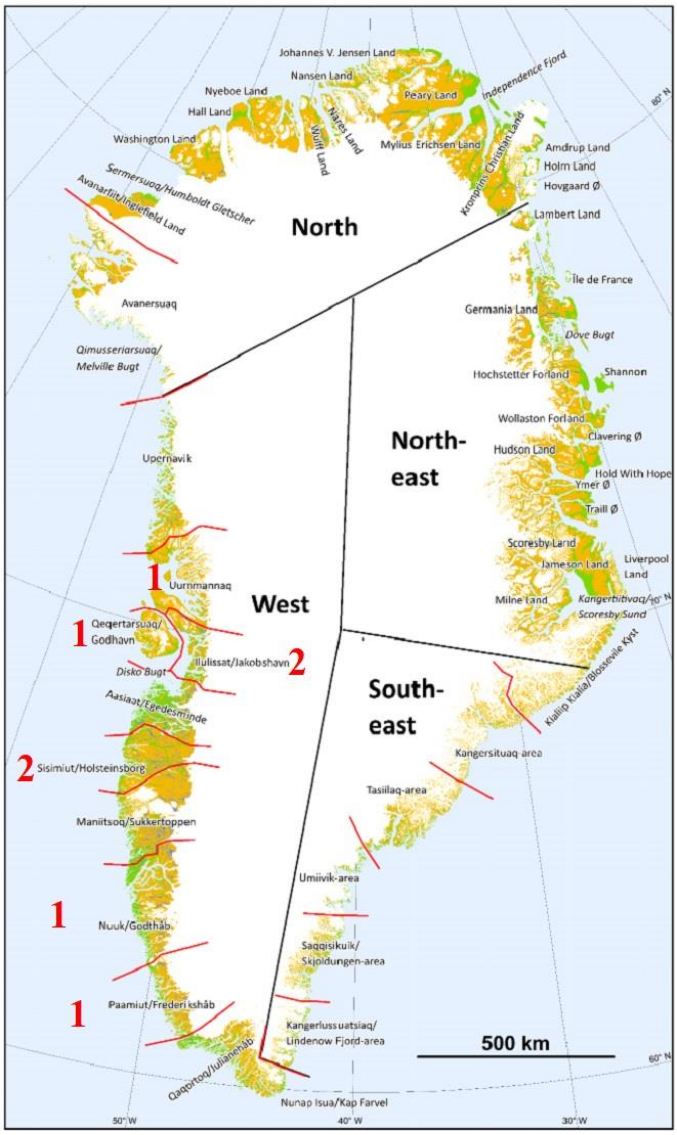
Sisimiut town, 10 Oct 2017, 1y (?) (N. Kristiansen in litt., RC 2020). —

Qeqertarsuaq/Godhavn: Offshore at 69, 23° N, 57,82° W, 26 Sep 2008 (M. de Boer in litt., RC 2008).

Ilulissat/Jakobshavn: Unknown site, Autumn 1970, 1y, (P. Grossmann in litt., RC 2001).

Ilulissat town, 27 Sep 2002 (F. Larsen in litt., RC 2002). —

Uummannaq: Niaqornat, 10–13 Oct 2008 1y (K. Kruse in litt., RC 2008).



*(**Fig. 4**) Greenlandic records of Rough-legged Hawks courtesy of David Boertmann*

On review of the records and having plotted their locations below (**figure 5**), I very much suspect this species is largely under recorded. This will come as little surprise given Greenland is the world's biggest island, has rough terrain and is largely uninhabited, with one of the lowest population densities in the world. On closer inspection, the smallest sea crossing from Cape Dyer along the Cumberland peninsula (Baffin Island) and Sisimiut town in Western Greenland is around a 330km sea crossing, as the 'Roughie' flies, across the Davis Straight.

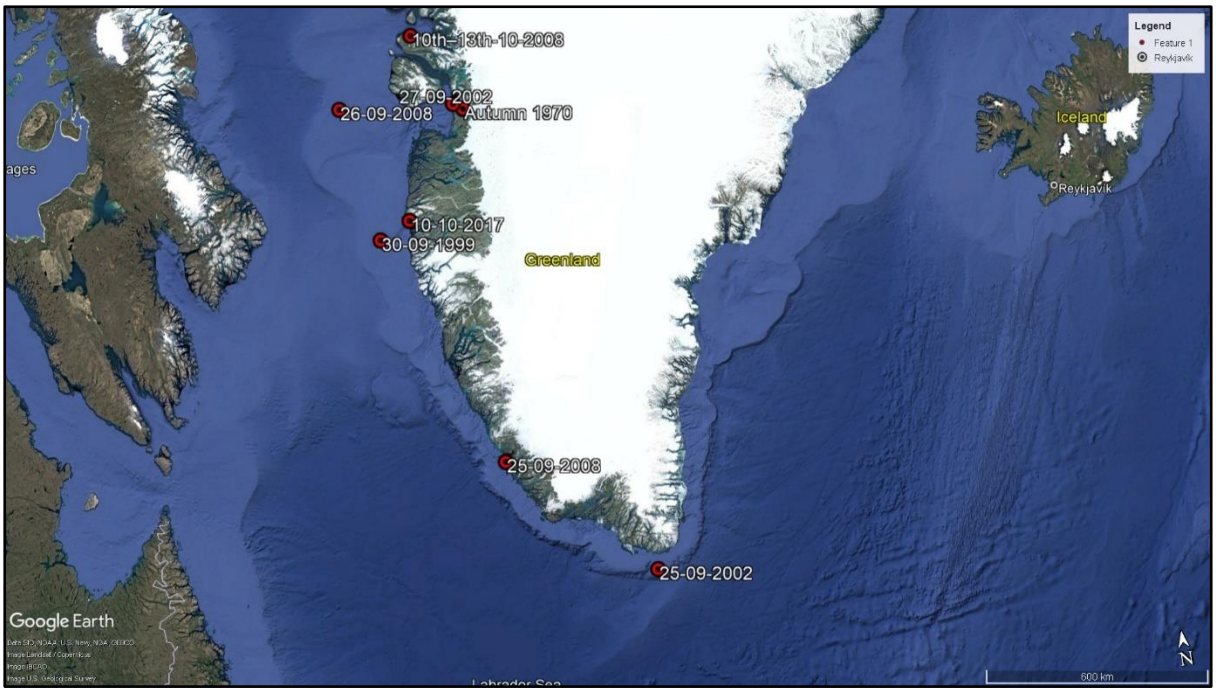


Fig. 5

Another route from along the same flyway would be the Newfoundland and Labrador route, involving a higher proportion of birds with a melanic gene flow, which again get caught up in southeast trajectory through juvenile dispersal - the funnel effect of the eastern flyway's topography and through strong westerly airflows on into the Azores and Spain etc.

A dark morph (more than likely a juvenile at the time) came aboard a Latvian fishing boat west of the Grand Banks at 350 miles east of Newfoundland at approximately 55°N, 48°W on the 13th September 2003 (Jensen, J-K. 2003. A Rough-legged Hawk on the Faeroe Islands. Birding World, vol 16, no 1 pp. 20-21). When the boat reached Tórshavn on the Faeroe Islands it was sadly in a poor state and was taken into care and kept in captivity until May 2006. It was finally released from a ferry east of the Isle of Noss, Shetland on the 5th of May 2006. Sadly, it died on the Faroes in 2008, having returned to the islands under its own steam (see links below).

Fig. 6

http://www.jenskjeld.info/artikler/RLH.pdf

https://www.google.co.uk/maps/place/55%C2%B000'00.0%22N+48%C2%B000'00.0%22W/@47.3733726,-13.5377716,3.29z/data=!4m5!3m4!1s0x0:0x63fa28249c4a538e!8m2!3d55!4d-48

Another remarkable record of vagrancy was kindly provided courtesy of Roy Brugman. A crewman aboard the motor vessel 'Taagborg', sailing from Baie Comeau, Quebec to Rotterdam in the Netherlands. This juvenile L/P RLH joined the vessel on the 6th of October in 2020, 433 nautical miles off the south of Greenland (53º14N, 039º36W) (see **figure 7**). Through personal communication with Roy, I was informed the bird was fed raw pork chop and was on board for about 3-4 days. The bird was not seen to depart the boat, and no corpse was ever found.

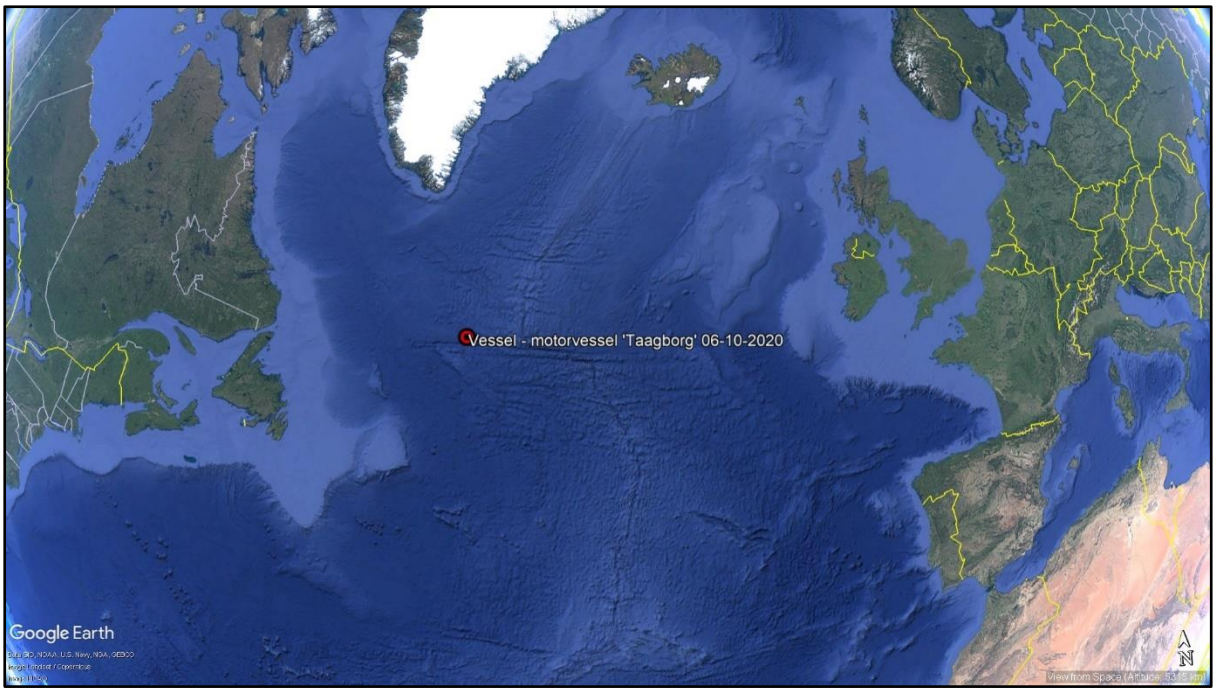


Fig. 7

*(**Fig. 8**) Juvenile L/P RLH onboard a vessel in the mid-Atlantic. Photo courtesy of Roy Brugman.*

It would appear a significant year for vagrancy of this subspecies was 2013. The autumn of that year became somewhat of the perfect storm for RLHawk vagrancy, as shown on the Azores and a record of a RLH on Madeira, Portugal during the same autumn. However, having reviewed some of the facts, it seems too many potential complex climatic variables were at play in eastern Canada to give reasoning as to why this vagrancy may have occurred.

However, what is clear was 2013 was also a hugely productive year for Snowy Owl (*Bubo scandiacus*) in Eastern Canada and saw a southerly invasion of these birds throughout the Quebec and the wider US.

https://blog.nature.org/2014/01/21/the-amazing-lemming-the-rodent-behind-the-snowy-owl-invasion/

The most common avian predators of lemmings in the Canadian Arctic include two specialist species, the Snowy Owl (*Bubo scandiacus*) and the Rough-legged Hawk. Seyer Y, Gauthier G, Fauteux D, Therrien J-F. Resource partitioning among avian predators of the Arctic tundra. J Anim Ecol. 2020;89:2934–2945. https://doi. org/10.1111/1365-2656.13346

Both Snowy Owls and RLH largely feed on Collared and Brown Lemmings (*Dicrostonyx groenlandicus* and *Lemmus trimucronatus*) respectively, which were well above average in numbers that year. This is nicely Illustrated in Denver Holt's crazy picture below (**figure 9**) taken within that year, during his studies of Snowy Owl.

Fig. 9

In parallel, irruptions of juvenile nominate RLB are similar and ordinarily mirror irruptive skua passage years, which is very much driven by these abundant prey years or prey pulses. These are normally followed by abundant prey years on roughly triennial cycles (Krebs et al. (2002) and a degree of synchrony in lemming and vole populations in the Canadian Arctic), as was the case in 2016/17, when L/P RLH were again observed and recorded on the Azores.

(**Fig. 10**) *Juvenile Rough-legged Hawk (Buteo lagopus sanctijohannis) on Corvo, Azores observed by Peter Stronach (29-09-2017) https://macaulaylibrary.org/asset/612286422*

Therefore, facts suggest this resource pulse increased RLH brood size and overall productivity, essentially meaning more juvenile RLH in the skies during the normal period of post-juvenile dispersal.

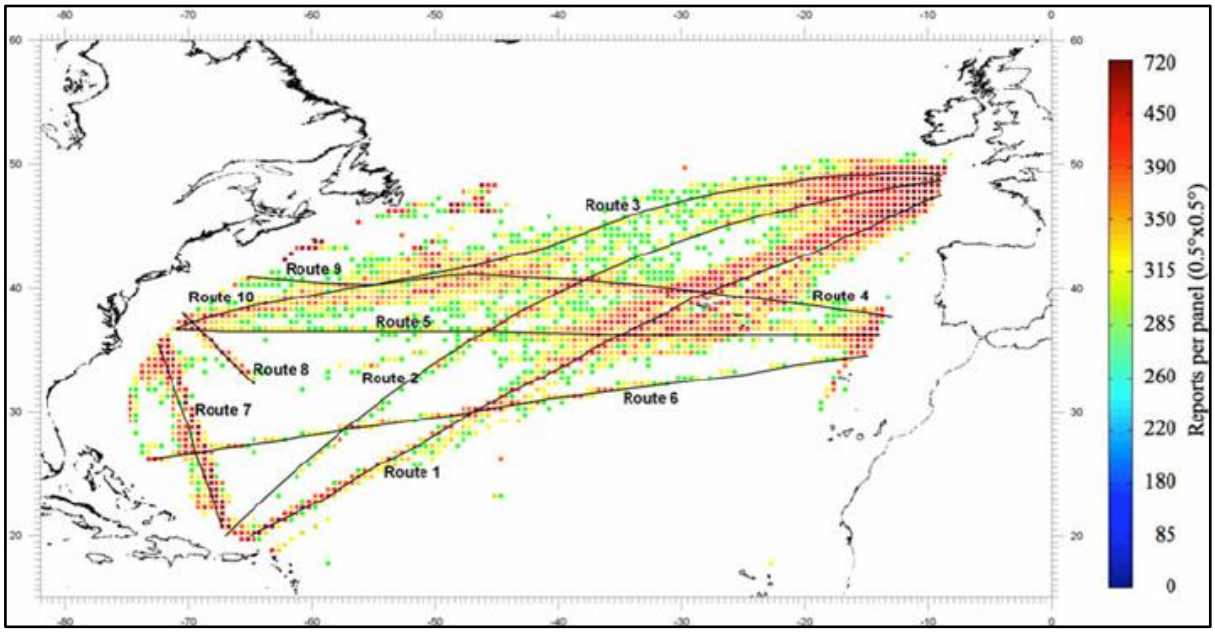
As we know juveniles (due to their inexperience) are more susceptible than adults to drifting in adverse winds (Ferguson-Lees, James.; Christie, David A. (2001) Raptors of the World (Helm Identification Guides)). Put very simply: more young birds mean an increased chance of landfall in uncharted waters.

Reading a little further into predator/prey relationships in RLH suggests there is naturally lower breeding productivity/smaller broods in northern breeders and larger broods in the southern population, the latter with a higher dark-morph gene flow! Does this therefore mean dark morphs are naturally more frequent on the irruptive front of juvenile birds or is this counterbalanced by their reduced dark gene flow in the overall population?

In addition to this, retreating sea ice has allowed access to more cargo ships as ice retreats along the Arctic shipping routes. This may have a degree of influence in some of the vagrancy to North Atlantic waters along the Arctic bridge route at the right time of year. As we know, sat-tag data on numerous species indicates ship assisted movements, where some migrating birds utilise a perch for some rest bite or during adverse weather.

Also, thanks to Alex Lees (a vagrancy veteran) who suspects RLH more likely join the major high traffic shipping channels at the grand banks.

Therefore, to summarise a hypothesis on vagrancy potential in this species, can we imply that a good breeding year in the northeast of Canada fuels an irruptive juvenile RLH movement, that topographically get funnelled down into the Newfoundland and the Labrador coast by a tail wind and out into the jaws of the Grand Banks? These naïve youngsters are then more susceptible to a westerly trajectory. Unwittingly, they find themselves flying into the confluence of two air masses resulting from atmospheric pressure near Iceland, tending to be low and air flows in a counterclockwise direction. Conversely, air flows are clockwise in high-pressure areas around the Azores. The meeting of these two air currents generates prevailing westerly winds across the North Atlantic and towards western Europe. Also, with increased ship traffic in the vicinity of the SE northwest passage and out into the Grand Banks must at times have only assisted vagrancy (as in the case of the juv dark morph above and on review of the records off Greenland).



(**Fig. 11**) Main shipping routes in the North-Atlantic sub basin courtesy of Vettor, Roberto & Guedes Soares, Carlos. (2014).

I find it mind blowing that the genetically established RLHawk, in the case of the Cornish bird (Bob Bosito et al), was just 22 km from the Falmouth port that is widely at the receiving end of high traffic shipping routes from North America. This is just 2100 miles at its nearest point to Cape Race in Newfoundland!...Yikes. Is this topographically influenced landfall or to some degree ship assisted vagrancy? In compiling this piece, numerous records would suggest this species (as is the case with Snowy Owls (see link below)) will and do take full advantage of vessels at sea.

https://www.birdguides.com/news/snowy-owl-arrival-causes-shockwaves-in-spain/#:~:text=This%20bizarre%20set%20of%20coincidences,Asturias%20birds%20were%20first%20found)

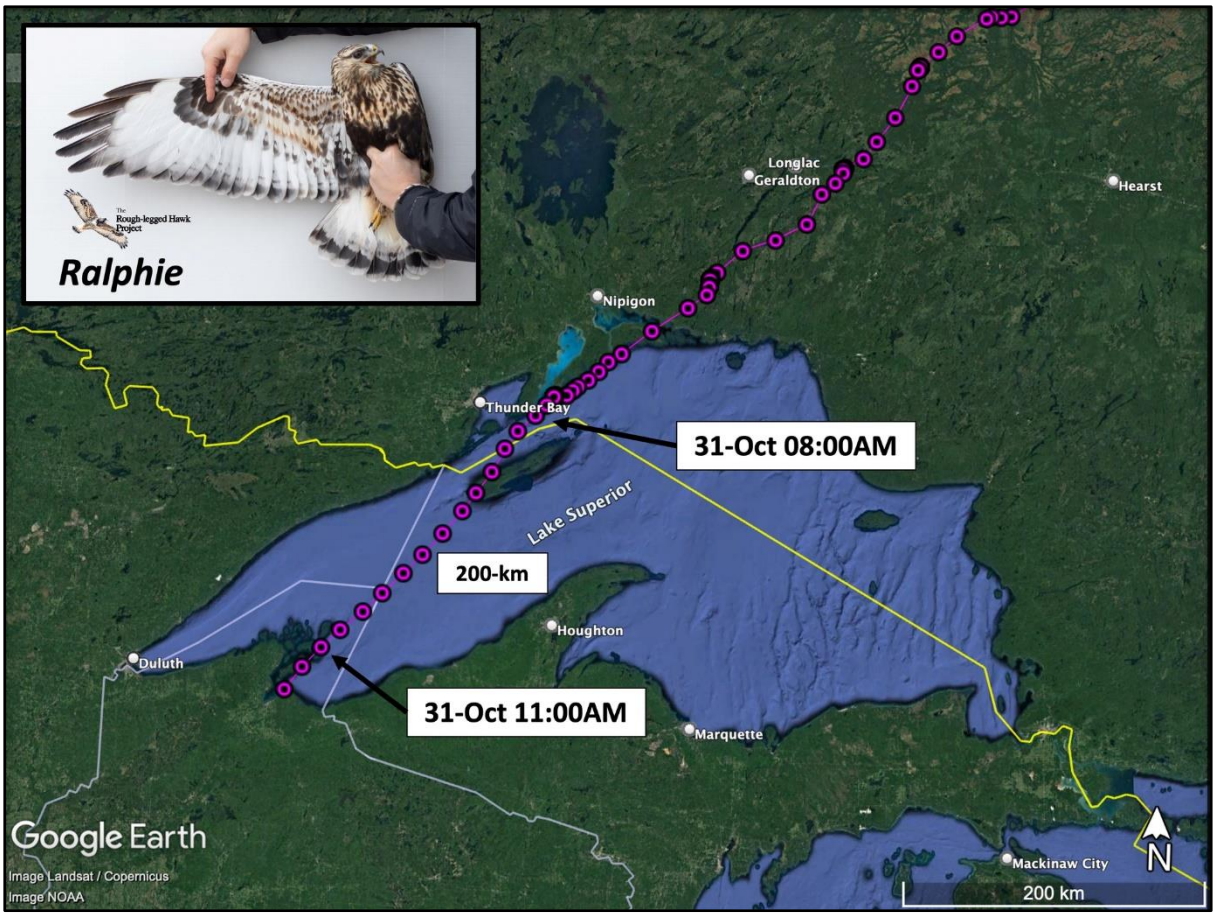
Equally fascinating is an occurrence of a cracking candidate juvenile L/PM RLH in Vega de Zarzalejos, Extremadura in Spain on the 12th of October 2021. The photos of this bird are kindly permitted for use by Felipe Zapico Alonso. I suspect this bird made landfall somewhere on the Azores (again at the receiving end of one of the most intense ship transit routes) prior to hitting the European mainland. I hope to revisit the bird's plumage progression throughout its first winter in the latter chapter.

‘Roughies/Rough-legs’ prior to 2024 were/are unsurprisingly still a very rare bird in Spain, with half a dozen records mainly restricted to Catalonia. These records most likely relate to extra limital L/P RLB (*Buteo lagopus*) wintering in the far northeast of the Iberian Peninsula, whereas a handful of birds in/around Extremadura (as with the bird photographed below) are more likely of Nearctic origin.

(**Fig. 12**) More on this bird available at:

https://crextremadura.info/cita/busardo-calzadobuteo-lagopus/https://macaulaylibrary.org/asset/378915931

Early studies by Neil et al (RLHP) appear to show RLH have a good degree of aptitude to make powered water crossings, given satellite-tag data recorded as birds move over open water (namely the great lakes and open seas) and have been observed sitting on ice flows for weeks at a time, highlighting their competence in/around open water.



*(**Fig. 13**) Ralphie (2nd winter male pictured) a RLHP sat-tagged bird highlighting the species' aptitude for an open water crossing.*

Then again, all my musings could be miles off the truth, which is what keeps me going with chasing the element of the unknown. What is very reassuring and exciting is to have raptor working academics driving these complex studies that may highlight how migration does occur along the eastern seaboard; that will ultimately enrich our understanding of vagrancy in Nearctic raptors.

With the above factors in mind, would it be right to expect a higher vagrancy potential of L/P morph juveniles, given the familial lines of light/pale morphs linked to the more arid, Arctic tundra up in the north/northeast?

Or does it suggest juvenile dark morph birds that occur as vagrants are Quebecers/Hudson bay birds which make up the majority of the individuals that occur in the Western Palearctic after departing out of the Newfoundland peninsula? Or simply is the wider birding awareness and more simplified ID criteria of the dark morph youngsters of this Nearctic race, mean that the light/pale morph birds get more overlooked as L/P RLB or even cast aside as Common Buzzards (*Buteo buteo*) at times, in certain locations.

What will be telling will be whether more irruptive vagrancy of RLH will occur with a greater frequency in Europe because of anthropogenic climate change. What is certain is the uncertainty of future Arctic weather. The Arctic tundra is a low productivity ecosystem with minimal habitat structuring, that supports relatively simple food webs (Krebs et al., 2003; Legagneux et al., 2014).

This makes this ecosystem even more susceptible to ephemeral events of resource superabundance or insufficiency of primary producers and primary consumers.

What is clear is erratic climate alterations will directly affect seasonal Subnivean climate conditions that could either benefit or hamper RLH prey. Reducing sea ice in Eastern Canada will likely increase sea traffic along shipping routes and ever-increasing intensity of Atlantic storms in September and October will continue to drive migrant raptors westwards.

With the above in mind let's have a quick review of autumn 2024!!!

4. Rough-legged Hawk vagrancy in Europe 2024

Sadly, due to work commitments I have been glacially slow at pulling this work together since initially starting these studies. However, fortunately autumn 2024 was an absolute windfall for these hare-footed stunners, with yet more trans-Atlantic arrivals. This provided yet more food for thought and a great way of implementing these studies to assist field identification.

Through personal communication with the Gouvernment du Quebec it sounded like an extremely productive RLH breeding season within their study area in Northern Quebec along the Hudson Strait. Raptor workers were reportedly tripping over lemmings! This was also reinforced by Rough-legged Hawk Project team, where observed data from the satellite tagged birds in eastern North America indicated that tagged individuals were residing in a single locality for longer periods of the boreal summer. This is unlike other years, where the data indicates the birds are ranging for food and not staying fixed to a location long enough to suggest breeding took place.

The above may help to explain the following 2024 influx of vagrant RLH along the European shores, with c12 individuals considered to be *sanctijohannis* based on observed location, time of year and phenotype/morphology. Of these, c10 individuals are considered putative L/P Morph RLH

(**Fig. 14**) *2024 RLH records mapped. An edited map belonging to Perry, Sarah & O'Mahony, Cathal. (2018). Stakeholder Processes in Marine Spatial Planning.*

Records of Putative RLH in autumn 2024 (L/P Morphs unless otherwise stated):

- 15th of October – 21st of October (Dark Morph*) Corvo Island, The Azores, PORTUGAL
- 16th of October – 18th of October Corvo Island, The Azores, PORTUGAL
- 20th of October – 27th of October Flores (two individuals) Morro Alto, The Azores, PORTUGAL
- 23rd of October, Serra de Arga range, Viana de Castelo, PORTUGAL
- 25 of October to the 29th of October (Dark Morph*) Morro Alto, Lagoa Branca, Flores, The Azores, PORTUGAL (could potentially be the bird from Corvo above)
- 26th of October between Carnlough and Waterfoot, NORTHERN IRELAND
- 26th of October Sao Miguel, The Azores, PORTUGAL (a bird also seen on the 24th of December may be the same or another individual)
- 3rd of November (remained to the 6th of November) between Sennen and Polygigga, Cornwall, ENGLAND

- Late October Iroite, A Coruña, Galicia, SPAIN. Believed to be the same bird that has wintered and as of March 2025 has relocated to Avila.
- 3rd November Tiétar, Cáceres, Extremadura, SPAIN
- 7th of November 2024 at Parco Ecologico do Funchal, Madeira, PORTUGAL
- 25th of October - 28th of November 2024 Vila Franca de Xira, Lisboa, PORTUGAL

NOW - let's explore L/P morph identification in case you're ever fortunate enough to encounter an extremely unfortunate trans-continental RLH.

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5. L/P RLH Morph Identification

To set the stage, and as mentioned, juvenile nominate RLB are monomorphic, whereas juvenile RLH are polymorphic, with three main phenotypes – dark morph, intermediate morph and light/pale morphs.

The dark and intermediate morphs are distinctly unique from juvenile RLB, whereas the pale morphs are at times VERY similar to one another.

Here I will explore the subtle spectrum of plumage types within the light/pale morphs (L/P morph) *sanctijohannis* where clinal range and humidity (touched upon earlier) look to alter the expressed phenotype.

The majority of L/P RLH phenotypes look to fall into three main brackets of tortoiseshell, ranging from calico types (some a lot whiter in places with minimal amounts of markings), to the more brindled tortoiseshell types with more saturated parts and stronger markings. Essentially a light, intermediate and dark pale morph (the latter occurring towards the dark end of the spectrum of L/P morphs, as in the case of the Cornish bird). With this the breast streaking and tri-coloured nature of mantle looks to vary as to where bird sits on overall 'tortoiseshell spectrum' of the light morphs.

This is something inferred by Tom Cade in his early work on specimens whereby he details supposed notes on *sanctijohannis* having a more variegated colours of the dorsal plumage. Whereas *B. l lagopus* is said to be characterised by a more uniformly brown dorsal coloration, by a light-coloured head relative to the back and by the absence of a melanistic phase.

The following are SIMPLY PROPOSED IDEAS (to be worked on) of my studies of skinned specimens - a vast array of photo libraries supplied by raptor working friends and observations in the field in the Western Hemisphere and Canada.

Firstly, and crucially - a tight definition of light/pale morph Rough-Legged hawk is virtually impossible!

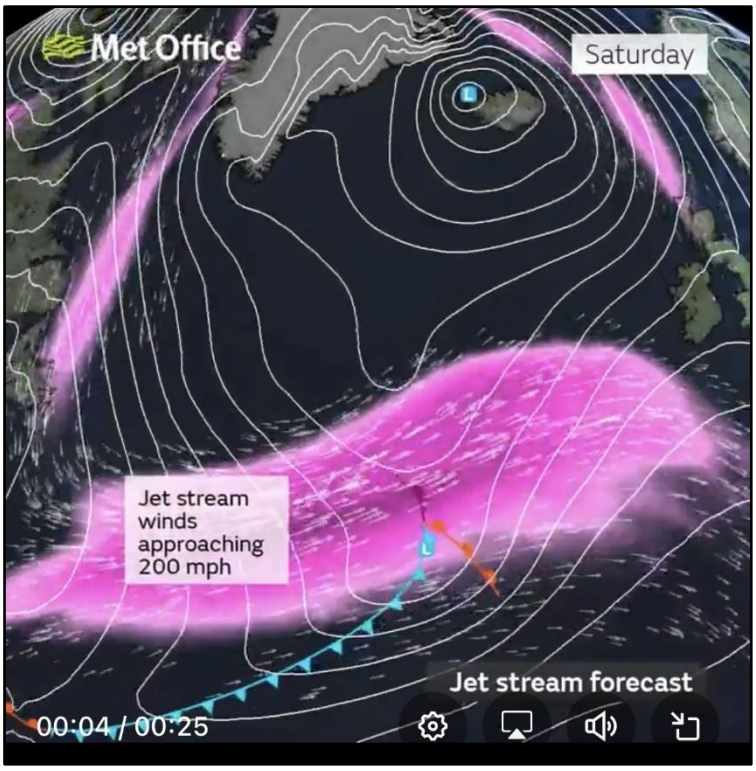
Summed up perfectly by Tom Cade: 'individual variability is great, but geographic variation is not.'

This is a bitter pill to swallow for a birder or for a budding taxonomist wishing to pigeonhole things to make lists look neat, tidy and definitive.

I would be foolish to think all L/P RLH are separable against RLB, but some are sadly not separable away from genetic analysis and blood work, coupled with biometrics. However, a good deal of them do express enough calico tones to label them strong Nearctic candidates.

A simple rule of thumb is to pay particular attention to any juvenile birds with a 'tortoiseshell' appearance and construct some detailed field notes of feather-by-feather features if you suspect they may originate from the Nearctic. This is especially relevant if it's a bird to have made landfall in an unusual location on the European west-coast, following adverse weather in the North Atlantic in/around late September - early October. The peak window for these cinnamon stunners, between 31-0 degrees west, looks to be the 5th– 15th October. Birds look to start appearing in Greenland from around 25th September at the earliest (not too long after birds leave the family unit).

However autumn vagrancy of L/P RLH in the WP seemed to occur a little later in 2024. This seems to have occurred in parallel to the unseasonably mild autumn/early winter in areas along the Labrador coast and lack of storms throughout early October, with precipitation and storms increasing with frequency on into November (Open-Source Material, 2024).



*(**Fig. 15**) Met Office weather forecast for the 17th of October 2024, with weather systems along the Labrador coast feeding the North Atlantic.*

My focus area for exploration into L/P morph RLH phenotypes is between the longitudinal lines of 50 – 100 degrees West. This is to mainly encompass eastern Canada and the geographic zone where the likely vagrants will originate.

Birders, please keep your mind open! I'm trying not to make it too confusing but please see this link and flip the idea on its head.

https://hawkwatch.org/blog/item/863-intermediate-rough-legged-hawks-your-call

Here the late mighty Jerry Liguori says some people would consider these intermediate darker morphic birds to be dark morphs and that is fine too...describing it as a "paler dark morph" is perfectly acceptable. Jerry shared these images so that the observer could be the judge if you see or capture one.

Apply this same rule with a light/pale morph RLH. You may have to treat some of these tortoiseshell birds as ‘darker light morphs’ (especially the very dark light morphs), as touched on above, given some of the expressed genes that are in circulation within this lighter morphism (more on this later).

Thoughts on field Identification of Light/Pale morph Rough-legged Hawk:

Dorsal ID Criteria

Head -

- A very similar cold contrasting pale head to European counterparts, with variable amounts of vertical shaft streaking of varying colouration. However most definitely more pronounced tortoiseshell hues in L/P RLH that can be quite pronounced in certain individuals. Almost always orange or brown vertical streaking (ranging from a pronounced wash to lineated streaks) but some with clearly defined tri-coloured feathers with marked dark central feather streaking (running along the shaft) that gets thicker, and more pronounced, towards the rear of the head and nape.

*(**Fig. 16**) Juvenile female L/P Morph Rough-legged Hawk, Quebec, Canada (73 degrees) 01-12-2023 courtesy of Nicole Richardson (RLHP).*

https://macaulaylibrary.org/asset/611775010

*(**Fig. 17**) Juvenile Rough-legged Hawks. Close up of heads of individuals caught between 73-103 degrees longitude courtesy of Neil Paprocki (RLHP).*

Something that I need to study further is the homogenous ground colouration of the head feathering. This feature appears to be dependent on the melanic gene flow (what I classify as the 'tortoiseshell spectrum') in the individual bird and would appear to proportionally influence how saturated the cinnamon tones are in the head. Washes range from a rich buff, butterscotch to a cinnamon white. This looks to correspond to the overall saturation of the breast, tarsus and vent (see ventral section below) and time of year.

Interestingly in some birds (namely freshly fledged autumn birds) these cinnamon hues can be so rich that the white forehead blaze (that sits above the cere and bridges the supraorbital ridge) really stands out against the rest of the head. The same applies to the chin in some degree. The same pale accents that pop in the forehead blaze in L/P RLH seem to mirror the colour in the marginal coverts around the leading edge of the wing. This noticeable in/around the carpal of a perched bird and somewhat on a bird with wing outstretched. The same level of contrast in these areas isn't as distinct in RLB in my opinion and gets lost within the paler tones of RLB even in October (prior to feather abrasion, with the onset of post-juvenile dispersal into harsher winter conditions etc).

(**Fig. 18**) *Juvenile L/P RLH showing a rich cinnamon buff basal colouration, exacerbating the paleness of the chin and forehead blaze. Courtesy of Malcolm Wilson (approx. 80 degrees west)*

(**Fig. 19**) Juvenile L/P Rough-legged Hawk, North Dakota, USA (103 degrees) 07-12-21 courtesy of Neil Paprocki (RLHP)

(**Fig. 20**) *Almost certainly a Juvenile L/P Morph Rough-legged Hawk courtesy of Yann Kolbeinsson Reykjavík 10-10-2000 (13th record for Iceland)*

*(**Fig. 21**) Juvenile L/P RLH Nunavut, Canada by Jenna Ainsley Hazel (between 70-80 degrees)*

*(**Fig. 22**) Young Juvenile L/P RLH Nunavut, Canada by Jenna Ainsley Hazel (between 70-80 degrees)*

*(**Fig. 23**) Juvenile RLB 16-11-2020 Kjell Janssens (near European continent, approx. 10 degrees east)*

I also believe (albeit anecdotally at this stage) that iris colouration and to a degree the gape flange colouration is worth closer scrutiny when accessing the suite of features in this subspecies. I personally don't think the iris colouration necessarily differs all too much to RLB, but it appears to show a slightly more greyish/bluish tint to RLB. Several things could be at play here as to why I think this. It could it be a Nearctic trait akin to the more bluish tints I've observed in the irides (coupled with the more yellowish/green hues of the gape flange) in juvenile Northern Harrier (*Circus hudsonicus*) in comparison to our juvenile Hen Harrier (*Circus cyaneus*). Could it be that the more commonly richer overall pigmentation of the head feathering in L/P RLH alters how our (well my) eye perceives the colour? Is the actual pigmentation of the iris altered when there is a greater melanic gene flow in the bird itself or is it that these L/P RLH tend to arrive marginally earlier to than when I commonly see RLB start to appear in the UK, so the iris coloration is naturally still developing from nestling dark, to intermediate blue to latte (the latter we see in the middle of winter)? Or it could be simply I've been focussing on Rough-legs all too long and my iris's themselves have altered. Either way, there are better comparative studies for fieldwork, but I find this fascinating.

(**Fig. 24**) *Iris colouration in young nestling Rough-legged Hawk, 31-08-2017 Iqualuit, Ninavut, Canada (68 degrees) courtesy of Fred Lemire Photography.*

*(**Fig. 25**) Iris colouration in Juvenile L/P Morph Rough-legged Hawk courtesy of Neil Paprocki. Ontario, Canada 04-01-2022 (Note the time of year) https://macaulaylibrary.org/asset/518213591*

*(**Fig. 26**) Iris colouration in Juvenile Dark Morph Rough-legged Hawk courtesy of Neil Paprocki, North Dakota, United States 19-01-21 https://macaulaylibrary.org/asset/529074511*

Mantle and Nape -

- What does appear somewhat clear is that, irrespective of the ground colouration of the head, I personally think L/P RLH have a more demarcated contrast between the rear of the head and the black shoulders (zone of the nape) compared to RLB, stemming from a different tone of black in L/P RLH. The black in RLH almost looks like a black blue (akin to when a black hair die or coal shines), whereas in RLB the black is a more muted black brown. This makes the white naturally look colder against a dark border in L/P RLH.

  * Please not this feature needs to be assessed alongside other features and not alone. It needs to be noted head streaking wears considerably through winter through abrasion, harsh light and other extreme environmental conditions, so fresh (recently fledged youngsters) will look altogether different to late winter/early spring birds.

(**Fig. 27**) *1st plumage Rough-legged Hawk, Douglas, Washington, United States 29-03-2023 (120 degrees), used as an example to show extent of feather abrasion in some spring birds, and how pale they can become in their second calendar year with feather abrasion and bleaching, prior to the commencement of their first moult in 2cy.*

https://macaulaylibrary.org/asset/551193341

- Most L/P RLH I had the privilege to study showed a tendency to show a distinct black scarf, where the nape joins the mantle. The feathers in this zone are predominantly dark with little orange or white hues.

- Remember both juvenile RLB and RLH show a distinctive demarcated mantle, giving the bird a dark rear triangle on their back. Of course, this is variable and can even be a dark spine of dark feathers in the palest of birds. However, tortoiseshell tones are more apparent in L/P RLH, largely born by mantle feathers that are dark centred with variable amounts of orange feather edging in the outer webs, not at all dissimilar to the mantle feathers in juvenile red kite (*Milvus milvus*). Could this be morphological radiation within Buteo's during speciation across the Nearctic?

*(**Fig. 28**) Juvenile female L/P Morph Rough-legged Hawk courtesy of Nicole Richardson (RLHP 01-12-2023) nicely illustrating the dark mantle triangle and orange scapular braces*

https://macaulaylibrary.org/asset/611775001

- The dark mantle is further pronounced in L/P RLH by the tortoiseshell scapulars; some birds show obvious orange braces (figure 29 below). In pale birds these tricoloured feathers are important in creating this feature. I found this more commonly in L/P RLH and never as obviously tortoiseshell or contrasting with the mantle in RLB. *Yes, there will always be RLB anomalies with white bases, orange outer webbing and dark centres and distal tips

Fig. 29

- A distinctively contrasting white nape is also apparent, accentuated by just how midnight black the scarf is in L/P RLH. In my opinion, I never see this level of clean-cut contrast, whereby the white nape collar meets a black nape scarf and then into a similarly dark mantle triangle in RLB. Be aware of warn and faded 1st summer birds (from late Feb/March) which show much clearer contrast in feather tracts, owing to wear and abrasion of paler/softer parts (as you can appreciate, plentiful in a migratory arctic species). This however does not apply to fresh autumn juveniles (which is what this work is designed to help uncover). The above feature appears to be more commonly found in 1st winter males and is a feature that also applies to juvenile male RLB. More on this in another study I'm working on.

*(**Fig. 30**) Nape and mantle zones of juvenile L/P RLH between 70-90 degrees west. Photos Jack Ashton-Booth*

*(**Fig. 31**) Nape and mantle zones of juvenile (monomorphic) RLB between 0-18 degrees east. Photos Jack Ashton-Booth*

All birds must be assessed on their own merits. The above photos are skinned specimens with variable amounts of individual feather abrasion, wear and feather bleaching, with their own stories of how they ended up in the draws of a museum. That said my sample size was relatively large (as were my observations/photo studies) and the feather topographical features I have focused on were apparent across the breadth of samples I studied, albeit subtle at times. If it's any relief I also believe these features are more accentuated in the field when an observed on a living bird in natural light.

Arm -

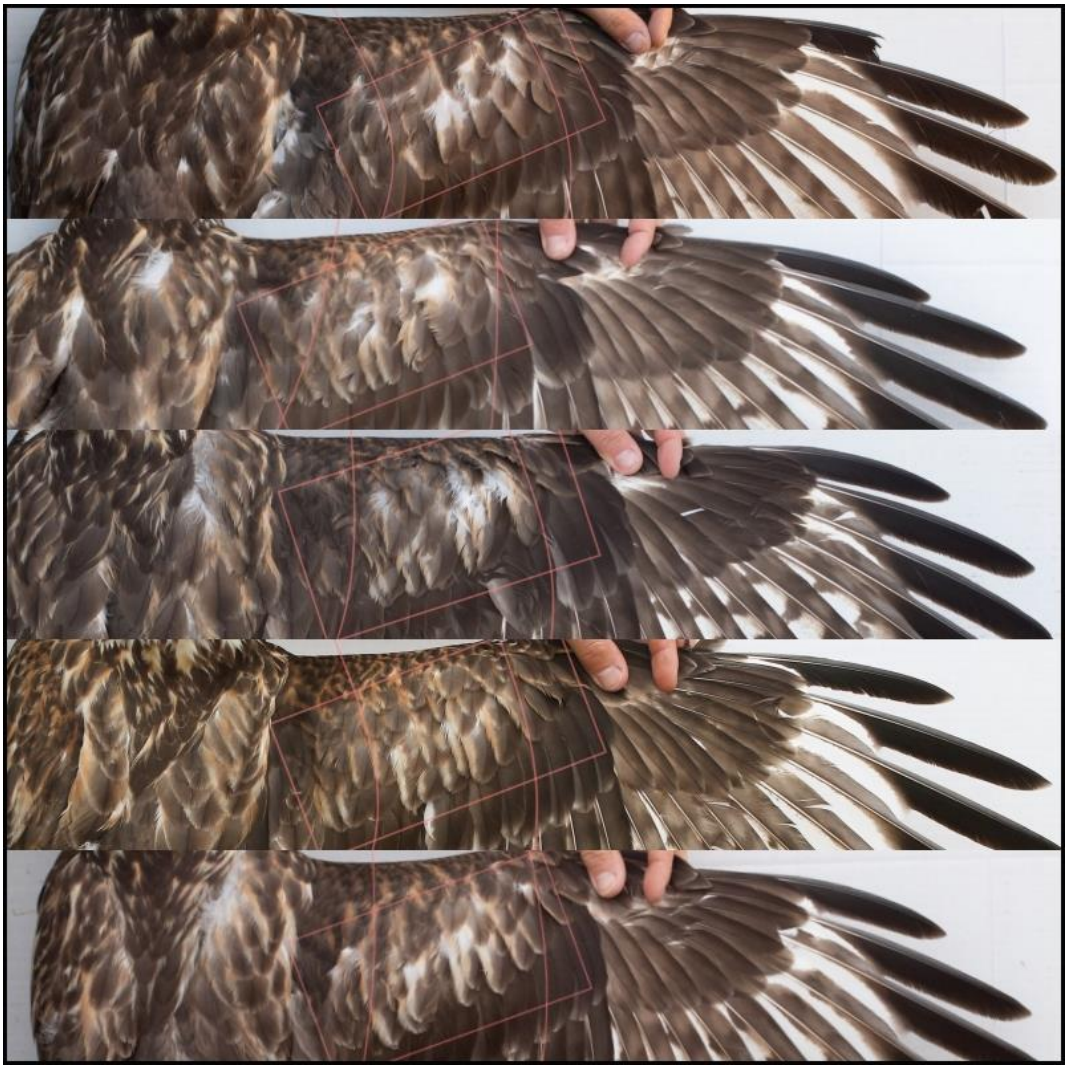
- This tortoiseshell/brindled effect observed in the head and scapular continues into the lesser and median coverts in the arm but needs to be assessed alongside other feather topographical features, as this can be found routinely in RLB. With this in mind, it is worth paying close attention to the area of median coverts (in the wing panel of the arm) where they correspond (above and between) greater covert 4 to around greater covert 12 (give or

take). Although routinely shown in RLB, RLB doesn't seem to show the same level of tortoiseshell patter expressed in L/P RLH. L/P RLH shows on average more tri-coloured feathers within this feather tract, routinely showing rich dark brown outer webs with variable amounts of accompanying extensive cinnamon tones, rather than the more bicoloured feathers in RLB with more marked, frosty pale inner web contrast, with restricted cinnamon tones giving a less tortoiseshell appearance.

*This feature is harder to assess as the bird's first winter progresses, as this feather zone is an area susceptible to abrasion and wear throughout winter.

*(**Fig. 32**) Median covert panel in a juvenile male Rough-legged Buzzard. This beautiful bird was sadly a road traffic collision (0 degrees, UK). This individual is particularly frosty (more on sexing in further work) and has little in the way of any cinnamon tones in the bases or inner webs of the feather zone 23-12-2018. Photo Jack Ashton-Booth*

*(**Fig. 33**) Median covert panel in a Juvenile Rough-legged Buzzard (10 degrees east) 16-11-2020. Courtesy of Kjell Janssens Slightly more cinnamon tones in this individual's median covert panel but not as intense as in the L/P RLH below and no real sense of the tri-coloured median coverts (be perceptive to saturated 1st winter female RLB).*



*(**Fig. 34**) A range of median coverts in juvenile L/P RLH between 73-100 degrees east. Photos courtesy of Neil Paprocki (RLHP). Although each bird is individually variable note the largely tricoloured pattern of the majority central median coverts and scapular braces (contrasting with the black nape/mantle feathering), giving these zones a largely variegated tortoiseshell pattern.*

Tail and rump-

In L/P RLH this is one of the most important areas for study I have found and really assist in helping to separate juveniles in comparative studies of the two sub-species.

- In L/P RLH the dark streaking along the central shaft of the rectrices has a much greater tendency to bleed and run high up the length of the feathers, ascending towards the upper tail coverts, sometimes even bridging the gap between the tail tip and the rump. Sometimes this bleeding can be so extensive it makes the white feather shafts (rachides) pop out, like a line of wet PVA glue against the darker bleeding.

- In L/P RLH the collective terminal tail band (ignoring the minutia of the fresh juvenile buff tips (aka the thin terminal band for argument's sake)) is much more solid and homogenous

in its completion along the distal portion of the rectrices, making the tail band all together more extensive and altogether darker looking, in turn reducing the white in the tail base. At distance this will give less sub-terminal demarcation and individual marked patterning/barring than in RLB, even from afar and from underneath. In RLB fragmentation in the collective tail band (composed of a series of consecutive transverse bars/bands) seems more of a consistent trend.

Fig. 35

- In L/P RLH a more distinctive 'HOOF' pattern (figure 35 above) is evident in each of the 12 rectrices (more akin to a typical juvenile Golden Eagle *Aquila chrysaetos*), where there is degree of bleed of tortoiseshell pigmentation (normally distally black - diffusing into bluish grey coal dust - into proximally orange) that rides or bleeds up the outer edges of the inner and outer webbing of the feather. Spawned most likely from melanic gene flow influenced by Gloger's rule, in which more humid conditions necessitate the need for this enrichment of melanism to protect feather condition, this is a key feature to remember and something to make note of and this pattern, formed by the webbing bleeding, should be more discernible from beneath a bird. *It must be said that although this bleeding does occur the overall impression of the tail band created by the 12 hoof patterns of each tail feather, again creates a more distinct and discernible complete tail band, owing to the intensity of the pigmentation of the melanism. Tail pattern in some well-marked tortoiseshell L/P RLH can even be suggestive of some adult (3cy+) female types in RLB. See image [9119071]. In the following link

https://ringersdigiguide.ottenby.se/species/buteo-lagopus/sex-autumn/

(**Fig. 36**) *Juvenile L/P RLH on Corvo, The Azores. Observed on the 29th of September 2017 courtesy of Peter Stronach. Note the extensive nature of the tail band bleeding up the outerwebs of the rectrices.*

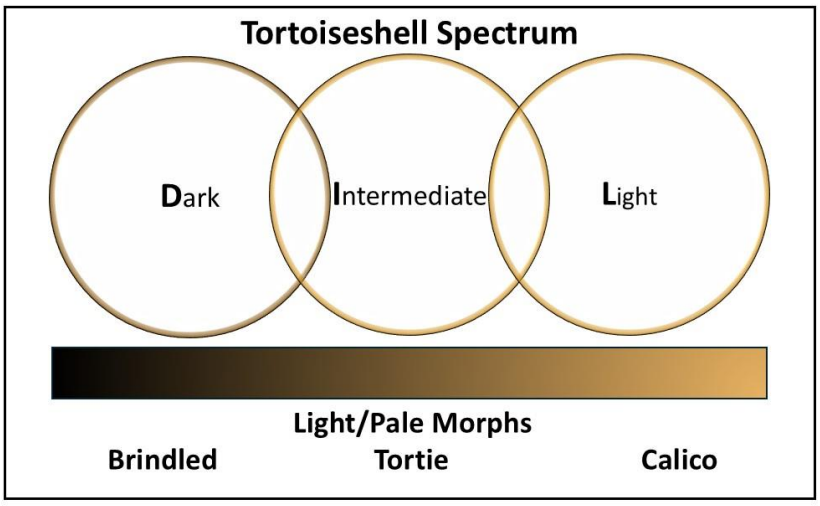
https://macaulaylibrary.org/asset/612286425

*(**Fig. 37**) Juvenile L/P RLH – A nice illustration of the extent of the hoof pattern in some individuals, very pseudo- juv Golden Eagle. Photo Yazzie Howahkan, Open Source 2024*

Essentially, the darker the light morph think 'DILL' (Dark/Intermediate/Light - Light-morph), whereby a more melanic/darker influence in the phenotype I've noticed a stronger hoof pattern per each of the respective rectrices. I believe this darker overall pigmentation may mask the transverse barring in L/P RLH seen more prominently in RLB in the fresh stages of the plumage, prior to 1st winter feather abrasion, Ultraviolet and extreme temperature exposure (see figure 38 below).

(**Fig. 38**) Juvenile L/P RLH Villacastín, on the provincial border with Ávila, Spain. 19th March to 10th April. These photos were kindly supplied by José Manuel Illescas via Alex Olle. It is believed to be the same specimen detected in Vega de Zarzalejos, Extremadura on the 12th of October 2021. Sadly, the same specimen was found dead under a wind turbine in mid-May 2022 by Juan Bernal and taken to the CR wildlife centre in La Alfranca. I've returned to this bird (as referenced in the vagrancy section) to illustrate the above points. The collage depicts the same bird approximately six months after it was first discovered. Although the photos are largely exposed, given the strong sunshine and the bird looks largely washed out, it is still clear that feather condition has clearly been abraded and bleached. The scapulars still appear largely tortoiseshell, but I have a feeling the dorsal 'hoof' pattern has abraded and has revealed the underlying traverse barring in the rectrices. Also, the fresh, juvenile cinnamon hues in the plumage tones will have naturally faded.

The Demarcation of tail barring or series of distal tail bands/traverse barring (that comprise the wider tail band in this age) seems less of a norm, or less pronounced (although there are certain individuals!) than in RLB. Diffuse peppered barring/spots are more regular and common in RLB than in L/P RLH. However, if individual L/P RLHs have more distinctive tail barring (more pro RLB) they still routinely appear to show distinctive tortoiseshell tones. Again, please assess with other features.



(**Fig. 39**) The **Tortoiseshell Spectrum:** 'brindled' Types (assignable to race), 'tortie' types (largely assignable to race) and 'calico' types (exercise caution – not normally assignable to race in the field on plumage alone)

In RLB the tail banding/transverse bars are on average more clearly demarcated and very last distal bar looks to float in isolation within the centre of the tail tip, creating a darker terminal triangle (if you will) of varying prominence. This is visible per each rectrix and these diffuse triangles can be individually observed against an altogether colder grey/brown and washed-out tail, and yes there are always anomalies and more richer buff/orange birds definitely do indeed occur and there is no disputing this. More on this later as it looks to be indicative of sex and is to be continued in future studies.

(**Fig. 40**) *Juvenile RLB tail. This tail lacks the more homogenous, richly marked, repeated 'hoof' pattern that you commonly expect to cloak the traverse barring in the distal tips of L/P RLH. As you can see the colouration in these feathers, including the caudal zone (rump & UPTC) are predominantly brown. In this bird, pigmentation towards the distal end of the tail feathers is largely fragmented barring, interspersed with small spots (quite unique). Orange tones are apparent in the outer webs but compared to L/P RLH this is not as tri-coloured or tortoiseshell as routinely seen in L/P RLH, not even at the calico end of the L/P RLH spectrum. Note the subtle dark isolated triangles at the distal tips (refer to fig). Photo courtesy of Kjell Janssens.*

- The distal upper tail coverts (UPTC) adjacent to a dark rump is also a very interesting area of study in RLH. The further away (descendant) from the body/rump the UPTC feather gets, it appears to revert to an orange bleed again, that looks to try and join the orange hues in the basal end of the tail band (imagine them being pulled together by an invisible force). In some of these orange feathers arise lovely frosty white tips, giving the distal rump a frosty scalloped look. The same shaped frosty UPTC tips do apply to RLB but the strong distinction of these feathers in the tortoiseshell colour palette in this tract is not as clear on average. RLB is browner and whiter and less strikingly auburn. The rump itself appears to be a darker brown blue/black in RLH (as in the distal tail band melanism), whereas in RLB it appears browner. Note that in both RLH and RLB the colour accent of the rump seems to match the colour accent of the mantle triangle and corresponding dorsal side.

*(**Fig. 41**) Juvenile L/P RLH kindly provided to me by Hannah Toutonghi, which nicely illustrates the discussed features above – this is an 'extreme' individual and a nest fresh youngster – just WOW!*

(**Fig. 42**) *Juvenile RLB (male) tail highlighting the difference between the sub-species in certain birds. No tortoiseshell tones in this bird whatsoever (rump & UPTC strikingly cold), each rectrix lacking the more complete 'hoof pattern', as well as being distinctly barred and washed out. Again, notice the subtle floating dark triangle prior to the worn buff terminal tips at the distal end of tail. Photo Jack Ashton-Booth*

This is of course a rule of thumb I have proposed and will be tested against the 2024 vagrants that turned up in Europe this fall.

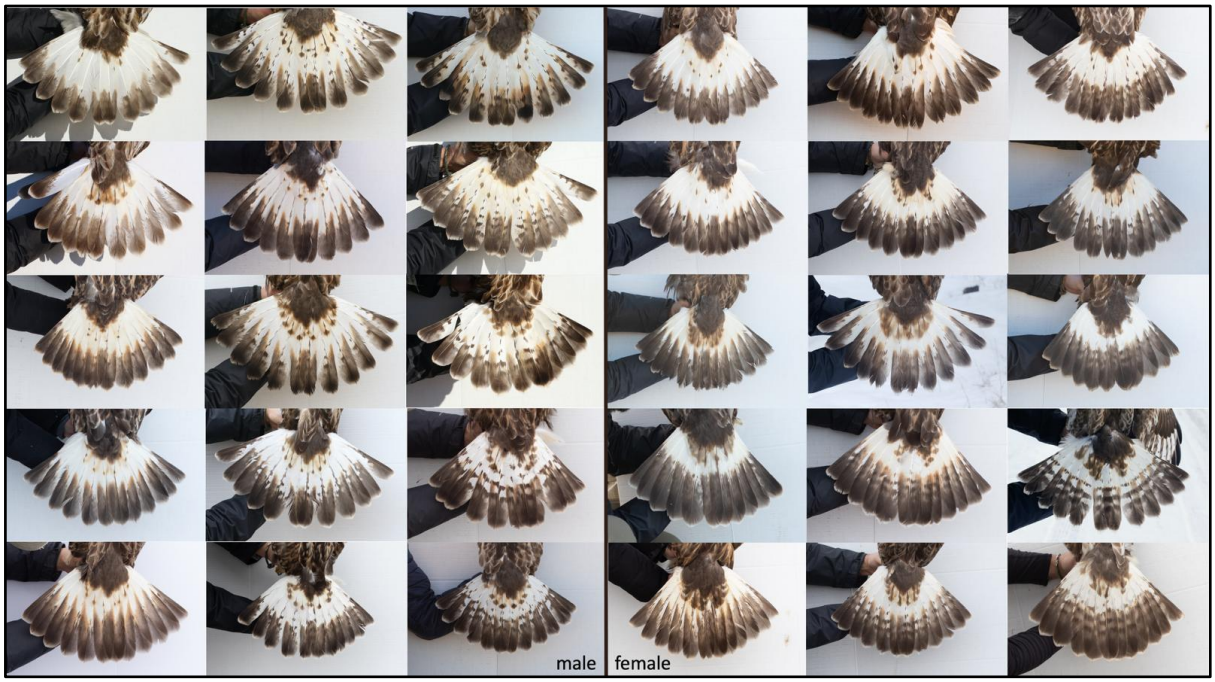
Out of completion I thought I would rudimentarily test the differences in colour saturation and tones between in RLB and L/P RLH. This was achieved by running similarly good quality

images of the dorsal sides of spread juvenile tails of birds in the hand and my photos of skins (dorsal side), both in Europe and North America (respectively) through image colour picker technology.

This tech extracts the overall colour palette and enables you to see how they compare. What was clear was supportive of my observed notes, with a marked L/P RLH showing autumnal Halloween hues stemming from the tortoiseshell pigment, which are far more saturated and common than when compared to washed older colder brown colour tones of RLB (see figures below denoting spread tails from a selection bird of each sub-species).

Footnote - in the longest upper tail coverts of both sub-species, the central shaft pattern varies considerably in shape. Ranging from a 'inverted gin glasses, ginkgo leaves, diamonds, rhombi or a series of stretched needle like rhombi (likened to dart flights).' At this stage of my study there doesn't seem to be any rhyme or reason as to this variability, other than genetic variation itself. I will review this with juvenile sex classification in future studies, but as I have found in the central shaft patterns in the white rumps of juvenile Hen Harrier, these features aren't always sex specific (merely genetic individual variation).

(**Fig. 43**) *A sample of dorsal sides of juvenile L/P RLH tails from skinned specimens from across the 'Tortoiseshell Spectrum'. Photos by Jack Ashton-Booth (many thanks indeed to the Natural History Museum, Tring)*



(**Fig. 44**) *A collage of the dorsal sides of juvenile male and female L/P RLH tails. Courtesy of Neil Paprocki (RLHP). When compared to RLB below the differences become surprisingly striking.*

(**Fig. 45**) *A sample of dorsal sides of juvenile RLB tails. Photos by Jack Ashton-Booth (many thanks to the Natural History Museum, Tring)*

Additional/weak supportive features whilst constructing this text/notes and something I will return to is the distal scapulars (working descendantly towards the rump). These feathers that protect the innermost tertials within buteos of the temperate zone appear to be routinely replaced or are at least one of the first feather loci to be replaced in juvenile buteos that I've observed. In L/P RLH they seem to accent the almost glossy blue black of the mantle and seem to mirror the distal tail tip with their colouration/tones. In RLB they appear stand alone in their freshness and more consistently don't accent the distal tail tip (terminal band (ignoring the buff juvenile tip)).

(**Fig. 46**) *Image by Roy Dudley: a calico type L/P Morph and not strictly from my study area (this was UTAH 112 degrees west in autumn 2021) but I love how this picture highlights the tortoiseshell tones and Ferruginous Hawk (Buteo regalis) like median/lesser coverts, expressed in some sanctijohannis.*

https://www.featheredphotography.com/blog/tag/rough-legged-hawk/

Ventral ID Criteria

- In my opinion the richer butterscotch tones (Squirrel Monkey (*Saimiri sciureus)* like tarsus) colouration in some of the L/P RLH from my extensive studies do indeed appear to have less

streaking/markings in the ventral zone compared to RLB. I think this is exacerbated by the overall richer saturation of this area in RLH, that further lessens the contrast with these markings and the markings simply don't pop, unlike the isolation of these darker markings in the paler tarsus in the majority of RLB, which draw your eye, and lessen the contrast with the belly patch in juveniles. The tarsi stand out in L/P RLH, as they actively contrast against the paler vent and under tail as the richness of the butterscotch buff is altogether darker in this area than paler vent and undertail. The long crural feathers in this species that aid insulation, also appear more unmarked than in RLB. For this reason, there looks to be less gradation and thus, more demarcation between the waistcoat and the trousers/tarsus in L/P RLH which makes the legs look more defined and more contrasting against the waistcoat.

*(**Fig. 47**) Juvenile L/P RLH - 'tortie type' with beautifully butterscotch, weakly marked tarsus and crural feathering (note contrast with rich waistcoat). Limited contrast with yellow tarsus scutes on the digits of talons. Photo courtesy of Alex Manofsky/Erik Brunkhe.*

*(**Fig. 48**) Juvenile L/P RLH (left) & Juvenile RLB (right). Frostier toned tarsus and crural feathering in RLB, especially true in juvenile males, especially as the winter progresses. Photo courtesy of Alex Manofsky/Erik Brunkhe and Kjell Janssens.*

*(**Fig. 49**) Juvenile male RLB crural and tarsus feathers (RTC victim), England (0 degrees). Not the cold frosty tones of this individual with contrast with digits. Photo courtesy of Richard Swales 05-12-2018.*

(**Fig. 50**) *Juvenile RLB crural and tarsus feathers, England (0 degrees). A well-marked individual with strong basal pigmentation & markings. Photos courtesy of Graham Catley.*

This is something I will continue to study. It could be argued that RLB have more streaked tarsus due to their lack of warmer basal pigmentation. Given this is an area of persistent attrition and contact with prey and habitat (true in both subspecies) may suggest the L/P RLH saturated trousers doesn't necessitate feather reinforcement in this area? Speculative at best.

What does seem apparent is what I link to the **'Tortoiseshell Spectrum'.** Whereby darker light morphs appear to have a tendency to show heavier streaked breast, (more pronounced/extensive marked malar to breast zone) flank markings, marked crural feathers, upper-tail coverts, central rectrix shaft markings, larger terminal tail band and a tendency to be more saturated, with accompanying ginger tones throughout their plumage (tarsus and underwing etc) that mirror each other.

This area definitely needs further study, but the crural feathers and tarsus colouration richness and saturation and amount of ventral streaking, I believe, depends on darker genetic influence and therefore features get more exaggerated on most feather tracts according to this influence (refer to 'tortoiseshell spectrum' in the 'DILL' diagram (figure 39), as do the basal undertones/colouration and overall buff saturation of the bird.

Ventral feathering looks to be directly influenced by this gene flow and the spectrum and concentration of shapes seen in RLB can be observed throughout the range of tortoiseshell types in L/P RLH. Variation of tarsus streaking ranges from thin needles – rhombus – to ginkgo leaves. I have more than a sneaky suspicion there is a degree of sexual dimorphism involved in how marked a bird is underneath - further complicating matters - but that is for another time.

The carpal area needs further study, but it would appear from initial observational studies that the greater primary underwing coverts are more extensively dusky (along their length) with a more intense sooty black, giving an impression of a rather more extensive carpal patch (however, hugely variable). The median primary underwing coverts that constitute the mid-carpal in both sub-species is very variable with tortoiseshell tones. That said the intensity of the black in the carpal in L/P RLH gives this tortoiseshell an intensity all its own, and most likely a carryover of melanistic genes within the darker gene flow in this subspecies, especially in the more humid natal zones. The tones in RLB appear all together browner and more muted.

Regardless of the subspecies, it would appear that whatever the tone and intensity of the dark parts are, this tonal shade is consistently expressed throughout the bird's belly patch (waistcoat), carpal patch, rump and mantle.

Putting theory in practice:

Time to test these initial studies with how useful they are in the context of field ornithology.

Given how variable the L/P RLH can be and how easily we could get bogged down as field ornithologists into intra-plumage classifications of these L/PM RLH, I have attempted to try to simplify their L/P RLH phenotypes for loose classification; within the 'tortoiseshell spectrum' based on the principle of a gradient value and how a bird's plumage governs to which end they fall within the spectrum, based on values of gradation. Loosely based on the extent of their markings in respective feather tracts, depending on where they fall across the tortoiseshell spectrum.

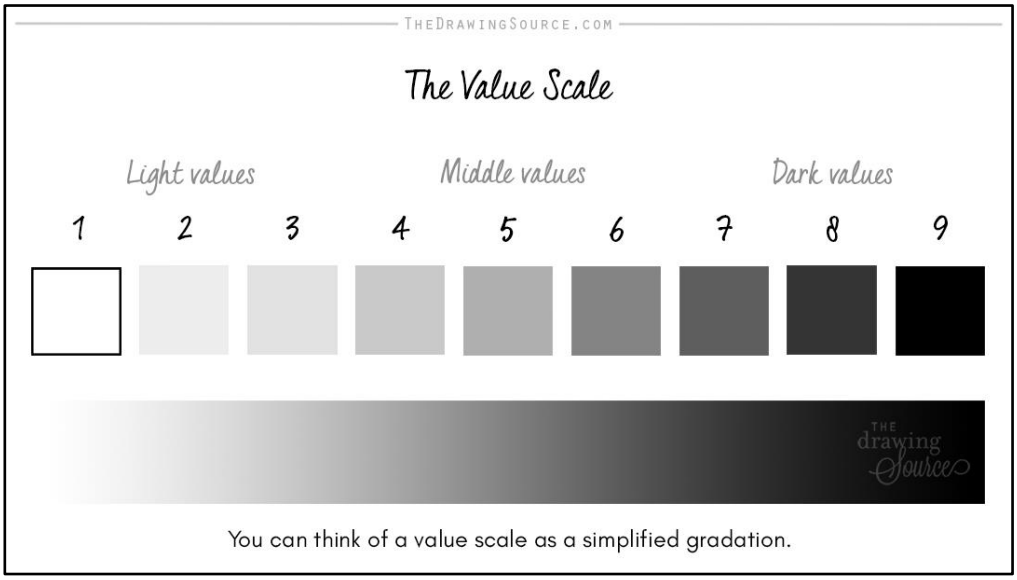


Fig. 51

Depending on where they fall allows us a field ornithologists to attempt to establish degree of confidence that we can assign a juvenile 'roughie/rough-legged' to a sub-species level and in turn a L/P RLH.

(Fig. 52) Light L/P Morph RLH. Photo courtesy of Malcolm Wilson. Lighter gradient values within the tortoiseshell spectrum – a more '**calico type'** (75-80 degrees west)

(Fig. 53) Intermediate L/P Morph RLH – Photo courtesy of Malcolm Wilson. More light to middle values throughout respective feather tracts - a '**tortie type'** (75-80 degrees west)

(Fig. 54) Intermediate to dark L/P Morph RLH. Photo courtesy of Malcolm Wilson. Middle to Dark values throughout the respective feather tracts: '**brindled type'** that would capture a birder's eye. (75-80 degrees west)

The latter 'Brindled' individual is not at all dissimilar to the following bird taken into rehab in Northern Ireland. Not all too far from the 2024 record in Northern Ireland in 2024 (see figure 55).

(**Fig.55**) *Photos available at*
https://www.facebook.com/media/set/?set=a.189479521141254.44145.156966131059260&type=3

These ‘brindled’ types show on average a more pronounced tri-coloured carpal patch, stemming from a well variegated tortoiseshell set of greater underwing coverts, that run the length of the arm, extending well into the primary greater underwing coverts. Something you can't sadly research all too well on closed skin specimens. The swarthy pigmentation further extends to the tips of the median and lesser underwing coverts, almost as if they've been brushed through coal dust. In my opinion this gives the ‘brindled’ types the impression of having a wing within a wing.

The pale gap between the dark tips of the median coverts and the dark tips to the greater underwing coverts appears to frame the skeletal anatomy of the bird's arm. This is especially true in this bird, with the coverts seemingly accentuating the humeral bone. Some well-marked ‘brindled’ types with lots of dark values can show an almost tiramisu like underwing pattern in the arm. As shown in the following bird on Corvo Island in Autumn 2024. Kindly provided by Vasco Valadares.

(**Fig. 56**) *Juvenile L/P RLH 'brindled' type, Corvo Island, The Azores, Portugal, October 2024. Photo courtesy of Vasco Valadares.* https://macaulaylibrary.org/asset/625060363

The following bird is a fine example of a bird that I would be very hesitant to ID to sub-specific level even with range or location indicators. This is in fact a L/P RLH that is very pro-RLB in its appearance!

This ‘calico’ type (figure 57) simply reinforces how caution needs to be exercised and all relevant identification features need to be assessed collectively and with great care.

(**Fig. 57**) *Juvenile March 2023 –Canada (80 degrees west) – at the RLB end of the tortoiseshell spectrum within the weaker end of the ‘calico types’ where light values dominate. Photo courtesy of Malcolm Wilson*

In summary and application:

Most raptor identification work is a constantly evolving process, which is why I’m currently in the process of devising a scoring system (to eventually accompany this paper) to try and simplify the assignment of L/P RLH within the tortoiseshell spectrum and in turn assist racial ID. This will be based on the excellent scoring system devised by Andy Stoddart/BBRC when trying to assign Redwing (*Turdus Iliacus*) to subspecific level based on their plumage characteristics. The status and identification of ‘Icelandic Redwing’ in Britain 2024 Vol.117: Pages 532–543

This will hopefully make this document more user-friendly for field observations of any *Buteo lagopus in* the Western Palearctic.

For now, I have itemised simplified ID pointers I feel are pertinent to the entire spectrum of juvenile L/P RLH phenotypes, if you happen to connect with one of these stunners. Not to be used alone but in conjunction as variable supportive pointers.

- White forehead blaze, chin and marginal coverts (along the leading edge of wing) vividly contrasting with rest of altogether cinnamon buff hues in fresh plumage

- Warmer, richer more saturated tortoiseshell basal hues of varying saturation throughout most feather tracts.
- Tri-coloured tortoiseshell scapular braces that contrast with a largely coal black dark nape/mantle triangle
- Coal black/midnight blue neck shawl that contrasts with a powdery white downy nape
- Tri-coloured dorsal median coverts that correspond (above and between) greater covert 4 to around greater covert 12. Creating a strikingly more tortoiseshell wing panel in the arm (some birds with complete cinnamon inner-webs to the median coverts)
- Squirrel monkey like tarsus – with more weakly marked rich buff/butterscotch crural and tarsus feathering. Less gradation and more striking definition with the lower skirt of waistcoat (belly patch).
- Pale frosted scalloped edges to waistcoat feathers appear to be more prevalent in RLB and in calico type L/P RLH (Sept-Nov). Not as evident and/or more buff toned in L/P RLH within tortie & brindled types. L/P RLH on average expresses more auburn margins where it meets the breast and vent.
- Ordinarily more extensive, more homogenous complete distal tail band (not including thin buff terminal tip), resulting in a more restricted white base. Spawned from a series of hoof patterns (12 individual hooves per the 12 rectrices) that bleed up the outer web of each rectrix
- Central shafts margins of each rectrix have more melanic pigmentation along the rachides, running towards the longest distal upper-tail coverts.
- Distal upper-tail coverts exhibit variably cinnamon-auburn tones contrasting against a richer dark brown rump. In some birds the UPTCs create a complete crescent. This diffuse crescent looks to try and join the orange hues in the basal end of the tail band (imagine them being pulled together by an invisible force), seemingly compressing the white tail base with tortoiseshell hues.
- Commonly less prominent transverse tail barring, masked by hoof pattern (brindled types are not to be confused with intermediate dark morphs which will show variable barring in the remiges).

<u>L/P RLH in Cornwall 2019 – the first confirmed British record of this subspecies</u>?

Dorsal ID Criteria:

Within my own tortoiseshell spectrum this specimen sits towards the darker end of the L/P RLH range and looks to be a ‘brindled’ type. Given what I have been taught and observed, this bird wouldn’t look at all out of place sat on top of an emergent maple in eastern Canada en route south for the winter.

(**Fig. 58**) *Juvenile L/P RLH hunting from the perch Montreal, Canada December 2023, photo by Jack Ashton-Booth*

This vagrant is strikingly similar to a juvenile female L/P RLH caught by Neil Paprocki (RLHP) on the 11 January 2022 in Vermont, Canada (73 degrees) https://macaulaylibrary.org/asset/515878881

I have made comparisons of the two birds to help illustrate the relevant features.

The Cornish bird has a rich saturation of tortoiseshell tones on display in the head, resulting from rich cinnamon undertones covering a large majority of the head feathers (namely in the medial portion of the crown, cheeks and bib). A large majority of these cinnamon feathers are centred with a relatively broad coal black vertical shaft streak, exacerbating the largely tri-coloured nature of the head.

(**Fig. 59**) *Deceased Cornish L/P RLH (top) and Vermont juvenile female L/P RLH (below)*

These warm tones accentuate the cold white of the forehead blaze (something true to the darkest of the dark morphs RLH) and the chin as discussed earlier in the article – making them pop. The contrast is further expressed in the cold white lower eye lids of this deceased individual.

The feathers in the rear of the crown revert to the same cold frosty white, as in the forehead in this bird. This creates a demarcated contrast with the intense blue black of the nape shawl and the dark mantle triangle (not all birds have white to black in the nape shawl, some birds express a more diffuse continuation of the cinnamon buff tones prior to the black nape shawl).

(**Fig. 60**) *Vermont Juvenile female L/P RLH (left) and deceased Cornish L/P RLH (middle & right)*

To my eye the nape and mantle area has an intensity all of its own in L/P RLH in contrast to RLB with a bluish-black, very much true to tone of L/P RLH (akin to black hair die or sheen of coal in some lights) and *sanctijohannis* in general. The intensity of this black around the nape shawl mirrors the black in the bird's mascara, eyestripe and malar and these areas are surrounded by predominantly black and cinnamon feathers that I have rarely witnessed in such saturation and extent in RLB at the same time of year in the UK or on the near continent (*some extreme birds do occur).

(**Fig. 61**) *Deceased Cornish L/P RLH (left) and Vermont Juvenile female L/P RLH (right)*

The strong tri-colouration of the rectrices can just be made out on the closed tail of the Cornish bird, akin to Vermont bird. These flight feathers showing cinnamon, brown and a coal dust hues, with a neat fresh silvery dentine tips. These tips mirror the lower (outermost) replaced scapulars and have the same coal coloured intensity. Pigmentation in the rectrices is extensive, bleeding up towards the proximal end of the feathers (especially the outerwebs), creating that diagnostic 'hoof' signature. These two individuals really give you the sense of an invisible force drawing the cinnamon bleed from the base of the tail band (excluding the silvery terminal tips) to the rich, auburn distal UPTCs, minimising the breadth of diagnostic white tail base of this species. The UPTCs in both birds are cinnamon, with centralised black shaft streaking (dart flights) and terminate with a subtle white frosted scalloped fringe.

Fig. 62

The caudal end of the rump itself has the same dark intensity as the neck shawl and creates a saddle like area when surrounded by cinnamon – auburn tones of the UPTCs and scapulars. I've personally never seen this in any juvenile RLB in the field, hand, skin or photograph this side of the Atlantic.

Ventral ID criteria:

Cinnamon hues richest and evident in the feather tips where the waistcoat gradates into the breast and vent. Lovely butterscotch, basal feather tones in the wider breast and vent either side of a super-rich, mahogany waistcoat (belly patch). Makes the true white areas pop out in/around the vent and the underwing. The relatively unmarked squirrel monkey-esque lower tarsus is nicely illustrated in these photos. As it happens, the crural feathers and tarsus markings are relatively well-marked in this individual, but not at all surprising given the extent of other dark markings expressed in this bird's darker L/P 'brindled' phenotype. Although very much still a light morph, the coarseness and intensity of markings on the breast side isn't surprising given the strong continuation of a well pronounced malar, which is discussed in the tortoiseshell spectrum earlier in my work.

(**Fig. 63**) *Vermont Juvenile female L/P RLH (left) and deceased Cornish L/P RLH (right)*

Hopefully one day I can get to see more of this beautiful specimen and have a wider look at other supportive features, including a spread wing. In conclusion, I'm personally confident that this is a darker light morph aka 'brindled type' L/P RLH Rough-legged Hawk based on ID criteria alone.

And not at all dissimilar to another bird photographed on the 19th of October in Iceland by Yann Kolbeinsson in figure 64 below.

(**Fig. 64**) *Elliðavatn, Iceland, 2007-10-19 – Yann Kolbeinsson brindled type juvenile L/P RLH*

Now to visit a few of the expressed phenotypes from autumn 2024 European records:

- 20th of October – 27th of October Flores (two individuals) Morro Alto, The Azores, PORTUGAL

(**Fig. 65**) Two putative L/P RLH (39 degrees) courtesy of Rui Pereira https://macaulaylibrary.org/asset/625322193 Brindled type on the left (see fig 56 & 57 above for plumage notes on the identification of brindled type) and a beautiful tortie type on the right, akin to individuals covered extensively in the identification section.

- 26th of October between Carnlough and Waterfoot, NORTHERN IRELAND

  After being briefly video recorded by the finder the bird sadly didn't hang around to be photographed in detail to allow for a thorough dissection of the relevant ID criteria but looks to be in the calico group from what I have briefly seen.

- 3rd of November (remained to the 6th of November) between Sennen and Polygigga, Cornwall, ENGLAND

A massive thanks to Jamie Partridge for allowing me use of his video material. Using this footage frame by frame has allowed me to isolate the majority of feather tracts I would wish to review, when assigning this/a juvenile to sub-specific level. For me this is a bird where caution needs to be exercised and with loose classification falls somewhere between a calico<tortie type within my tortoiseshell spectrum of expressed features and more towards the calico type. True colour is hard to ascertain without having seen the bird in the field. However, the warmth and colour saturation of the plumage hues looks striking when compared to the Common Buzzard in the lower left frame.

Pro – L/P RLH

- Forehead looks to pop in contrast to pale cinnamon hues in head.
- Nape and mantle triangle is strikingly contrasting alongside the warm tortoiseshell scapulars.
- The neck shawl looks well marked and melanic.
- The main median coverts in the arm look uniformly tortoiseshell. Less tri-coloured than normal in these pics with little white and are relatively in keeping with the rest of the majority of dorsal contour feathers.
- The rump saddle is a lovely dark tone and mirrors the melanic tones of the tail band.

Pro – RLB

- In other pics I've seen the bird has well marked, almost spotted crural and tarsus feathering
- Pale cinnamon hues to overall body colouration
- The rectrices are distinctly barred with limited tortoiseshell tones at the basal end of the tail band or distal upper tail coverts to promote the bird to a tortie type. A degree of pigmentation looks to run up the outer webbing but no obvious, real suggestion of the hooves I'm looking for.
- Distal upper tail coverts are subtly rusty, but I feel within RLB range. I just wish there were more russet tones on display at the base of the tail band, namely on the outer webs of the rectrices.
- Pale chin and leading edge of wing not strikingly glowing as in some birds

In conclusion this is a great study subject and just shows how even within a restricted European 'irruption' of putative L/P RLH not all individuals are easy to assign to sub-specific level and a suite of features can contradict one another. If this was a bird that rocked up on the east coast on the back of a north easterly airflow, I suspect this would largely be overlooked as anything other than a *Buteo lagopus.* This is more than certainly likely a L/P RLH on its location and time of year, however this is certainly not one I would call without blood, feather or biometric work, but would probably be a

very different individual up close and in the hand. Other photos may arise that show features in a different light.

(**Fig. 66**) 1st winter putative L/P RLH Cornwall, England, November 2024, Jamie Partridge

- 3rd November Iroite, A Coruña, Galicia, SPAIN

  The following photos were kindly provided by Juan Sagardía and Àlex Ollé, and in my opinion depict a stunning juvenile 'tortie' type L/P RLH. This bird is now residing in Ávila and is believed to be the individual that was initially observed in Galicia.

(**Fig. 67**) *Juvenile L/P RLH, Ávila, Spain (4 degrees) March 2025 courtesy of Juan Sagardía*

(**Fig. 68**) *Juvenile L/P RLH Quebec, Canada, December 23 (73 degrees) Photo Jack Ashton-Booth (left) and juvenile L/P RLH Ávila, Spain (4 degrees) March 2025 (right), courtesy of Juan Sagardía (flight comparison of dorsal side)*.

(**Fig. 69**) *Juvenile L/P RLH Ávila, Spain (4 degrees) March 2025, courtesy of Juan Sagardía (left) and Juvenile L/P RLH Quebec, Canada, December 23 (73 degrees) Photo Jack Ashton-Booth (Right) (flight comparison of ventral side).*

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7. Acknowledgements

The above work is not definitive guide to L/P RLH, far from it. It is merely a collection of my research and thoughts to help broaden and further the discussion of this subspecies with piers who are interested in raptor identification.

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