Observations on fish-eating birds on the River Usk, in relation to the smolt run 2020

Guy Mawle

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guy.mawle@gmail.com

'Very few cormorants invaded the River Usk in 1963 … the goosanders again accompanied the downward migration of smolts.' Usk River Board (1964).

'The goosanders are the chief predators of young game fish, particularly while the smolt migration is in progress.' Usk River Board (1965)

Summary

- The abundance of fish-eating birds in Wales has increased while the status of salmon, both adult and juvenile, as a key feature of the River Usk Special Area of Conservation is now severely depleted. One potential contribution to its recovery is to reduce predation by fish-eating birds, particularly during the smolt run. This note supplements the report by Mawle (2019) on observations from 2018 & 2019.

- Records of fish-eating birds were made on the lower Usk at two sites: Usk town, mostly from February to May 2020; and Llangybi from November 2019 to June 2020.

- At Usk town, a lower density of goosanders (*Mergus merganser*) was recorded in 2020 during the spring, when smolts migrate, than in 2018 or 2019. However, the period when birds and smolts coincide, with potential predation, was expected to have been longer. Smolt migration was likely to have started earlier in 2020, due to higher water temperatures in early April, and extended by lower flows than in previous years.

- At Llangybi, a more rural environment, 3 km downstream, goosanders were more wary of observation than at Usk town and more difficult to see because of extensive vegetation.

- The abundance of fish-eating birds recorded at Llangybi was low from November to January but substantially greater from February to mid-May. If this disparity is widespread it could result in NRW's survey, commissioned for winter 2020/21, understating bird abundance in the spring during the period of potential predation on salmon smolts.

- Average densities of goosander recorded during the smolt run were lower at Llangybi than at Usk town but more cormorants (*Phalocrocorax carbo)* were recorded. More information is needed about the distribution of birds along the river to improve estimates of potential predation of the whole smolt run. It is hoped this will be provided by the NRW survey.

- Male goosanders left the river earlier than in the last two years, due perhaps to the exceptionally sunny weather. There were few adult goosanders recorded after mid-May, other than females with broods of chicks.

1. Introduction

The Atlantic salmon (*Salmo salar* L.) is a designated feature of the River Usk Special Area of Conservation (SAC). The feature should be maintained in favourable condition as defined by the status of both its adult and juvenile stocks (CCW, 2008). Natural Resources Wales has made no formal assessment of the features of the Usk since 2013. However, the adult salmon stock was 'probably at risk' of failing its management objective for egg deposition in 2019 (Cefas et al, 2020). Another electrofishing survey in 2019 found juvenile distribution and abundance to be poor, as it has been since 2016 (NRW, 2019). The declared rod catch of 129 salmon from the Usk in 2018 was the lowest since records began in 1871, with little improvement in 2019 (NRW/EA, 2020). Although there was some improvement in adult stocks in 2020 (Mawle, 2020), there is little doubt that the status of salmon as a feature of the Usk SAC, like most other features of this site, remains 'unfavourable'.

From 2020, all legal fisheries, both rod and net, in home waters have been closed or are catch & release only. To supplement these controls, NRW (2020a) has a 'Plan of action for salmon and sea trout in Wales' to tackle the 'salmonid emergency'. Part of this plan is the development of another 'Forward delivery plan' for 2021-23 that will include 'tackling predation by fish-eating birds', a key problem perceived by fisheries interests to be limiting stock recovery. Nationally, the main species of concern are goosander (*Mergus merganser*) and cormorant (*Phalocrocorax carbo).*

Figure 1 shows that, other than in the last decade or so, there is little evidence of a negative relationship between the increasing number of over-wintering goosanders or cormorants in Wales and the abundance of adult salmon in the Usk, as indicated by rod catch. That does not mean that predation by goosanders does not reduce, perhaps substantially, both the number of smolts leaving the Usk and the number of adult salmon returning. As noted by Russell et al (1996): '*Predation of smolts will reduce the numbers of adult salmon returning from the sea, as the rate of return of adult salmon is proportional to the smolt output*'. Rather the lack of a negative relationship might indicate that there have been other significant factors affecting salmon stocks, either positively or negatively; some of the latter have been recognised and addressed, some not.

Increased predation by birds may not have been a key factor in the recent collapse of salmon stocks in the Usk. Nonetheless, the reduction of predation, especially on smolts, might aid their recovery. Mawle (2019) reported a limited presence on the Usk of cormorants, compared to goosander, before and during the smolt run. On the basis of goosander abundance in the springs of 2018 and 2019 at Usk town, an estimate was made of predation during the smolt run and hence subsequent adult returns to the Usk. While some assumptions were, and remain, uncertain, the impact could be an order of magnitude greater than that of the rod fishery before the introduction in 2020 of mandatory catch & release and other restrictions on fishing.

The Wales Fish-Eating Birds Advisory Group is currently reviewing policy to make recommendations this year, 2021, on bird predation (NRW, 2020b). Additional evidence is needed including on the abundance of over-wintering cormorants and goosanders in 'Important salmonid catchments' such as the river Usk, as opposed to Wales as a whole. There also needs to be a distinction between abundance on still waters and on rivers, though of course birds may move between the two habitats. NRW is therefore commissioning local

counts this winter, December to February 2020, including on the Usk where, in view of the data reported in this note counts may be extended into the spring (Patrick Lindley, pers. comm.).

This note has been offered to the Advisory Group together with Mawle (2019). It documents the abundance of fish-eating birds at two locations, Upper Llangybi and Usk town, on the lower river Usk in the spring of 2020; and at Upper Llangybi in the preceding winter. It supplements, rather than reiterates the results and conclusions for 2018 and 2019 in Mawle (2019).

2. Locations and method

2.1 River conditions

Daily mean values for the river height and water temperature at the gauging weir at Trostrey (NGR SO 35841 04208), upstream of Usk, were provided by NRW.

2.2 Usk town

As in 2018 and 2019, the numbers of cormorants and goosanders were recorded along about half a kilometre of river shown in Image 1. The observer, Chris Brain, usually recorded whether the goosanders were adult male, redheads or chicks taking '*great care to avoid double sightings of birds which may take flight*'. Most records were made from 4 March to 31 May 2020 when goosanders and/or cormorants were invariably present. During the high water prior to that, fish-eating birds were often absent from this stretch. Counts were made in the afternoon between 1530 and 1800 hours or in the morning, generally between 0800 and 0930.

The river channel in Usk is essentially straight with embankments, having been modified to provide flood relief for the town, with well-used paths on both banks. There are gravel shoals at the Island and the Dogger which are covered on higher flows, otherwise no islands or backwaters. As shown in Image 1, much of the channel is lined with trees or other vegetation.

2.3 Llangybi

This location is about 3 km downstream of Usk town. The numbers of cormorants and goosanders were recorded on 65 occasions from 23 November 2019 to 1 June 2020 along about a kilometre of river. Counts were mostly on the east bank (51 occasions) from Lower Parker's Pool ST 385 986 to ST 979387, the mouth of the Olway Brook; on the west bank from ST 385984 to ST 386975 (10 occasions); or, when flows were low and the river could be easily crossed, both banks (4 occasions). Birds were recorded usually over about an hour in the afternoon or, on five occasions in May, in the evening. The stretch walked offers a different environment to Usk town. Though there are occasional visitors, there is no public access and the birds seem more wary of humans. During the winter, flood pools form in adjacent fields which are used by a range of waterfowl including ducks, swans, geese, herons and gulls. There are three gravel shoals, partly vegetated, that are covered by higher flows as

well as a long-established wooded island. On one side of the island is a backwater that, like the flood pools, provides an area of quiet water on all but flood flows and is used by waterfowl. Most of the banks, and the one substantial island, are well-vegetated, limiting the view of the channel, especially in late spring.

3. Results

3.1 River conditions

3.1.1 Flows

Figure 2 shows that the river was high from November 2019 to late March 2020 with flooding at Llangybi on several occasions, including an extreme flood on 16 February. The Met. Office website provides time series data for the weather in Wales: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-temperature-rainfall-and-sunshine-time-series . It was the wettest winter (December to February) on record in Wales. In contrast, the spring was exceptionally sunny and generally dry. Other than a small rise at the end of April, flows dropped steadily to very low levels at the end of May. Figure 3 shows that while flows at Trostrey in March 2020 were similar to those in the previous two years, they were much lower in April and May. Flows at Usk and Llangybi were even lower due to Welsh Water's abstraction at Prioress Mill, just upstream of Usk and downstream of Trostrey. Even in the second half of May, abstraction continued at about 75 Ml/d, though supported from 13 May by a regulation release of 50 Ml/d or so from Usk reservoir at the top of the catchment.

3.1.2 Water Temperature

The average daily temperature at Trostrey during the latter part of March 2020, shown in Figure 4, was similar to that in the previous years but increased sharply after the beginning of April. It exceeded and remained above 10°C from 4 April, a fortnight early than in either of the previous two years.

3.2 Observations of fish-eating birds

3.2.1 Usk town

As shown in Table 1, a cormorant was recorded on only one of the 27 days for which records were made from 1 January to 31 May.

In contrast, goosanders were recorded on 25 days from 4 March to 31 May. Daily counts of adults averaged 2.8 and did not exceed five in 2020. This maximum was recorded on two occasions in mid-April: first, a group of five males; then, on 13 April, three males and two redheads. Five adult birds were also recorded on 4 May, the last day a male goosander was seen. As shown in Figure 5, this was also the date on which a brood of chicks, seven birds, was first recorded. A brood of eight chicks was seen subsequently, confirming the observer's suspicion, at the end of March, that: '*2 pairs were resident in the stretch walked.'*

The average number of adult birds recorded per visit from March to May was 2.8. For the period 11 April to the end of May when smolts and goosanders were both likely to be present, the average per visit was 2.7 adult birds.

Table 2 shows where goosanders were seen on the river, in relation to the locations in Image 1, and if they were seen feeding. They were most commonly seen on or around the Dogger gravel shoal and were recorded least on the deeper pools: the Bell, Bridge and Old Railway bridge. Except for the Bell pool, goosanders were seen feeding everywhere they were recorded.

3.2.2 Llangybi

3.2.2.1 Cormorants

In contrast to records at Usk town, cormorants, albeit in low numbers, were observed quite frequently. They were recorded on a third of the visits, 22 of 65, listed in Table 3. On average, one cormorant was recorded for every two visits. The average number of cormorants recorded per visit was lower in November/December 2019 than from January to May 2020, as shown in Figure 6.

There was clearer evidence of a local presence on the water in the spring, shown in Figure 7. Only two of the nine cormorants observed before March were on the water (22%); the others were flying, potentially between different locations. In contrast, after the beginning of March, eight of the nineteen recorded were seen on the water (42%), generally hunting, while four (21%) were resting nearby, either on a gravel shoal or in a tree. On two occasions, on 2 & 17 March, a cormorant was seen on the lower reaches of the Olway brook just before it enters the main river Usk.

3.2.2.2 Goosanders

As detailed in Table 3, from February through to 19 May, goosanders were recorded on every one of 38 visits except three; and on one of the latter, it is likely that any present would have been disturbed by a dog walker. Prior to this, from November to January, fewer goosanders were observed, as summarised in Figure 8.

The maximum number recorded on any one occasion was fourteen on 8 March. Of these, eight were in a flock on flood pools adjacent to the river, the other six being in two groups of three on the river. In winter on high flows, up to the 11 March, goosanders were often seen on these flood pools, as in Image 2, usually with other species of water fowl.

The average number of adult goosanders recorded per visit from the beginning of March to the end of May was 3.0. For the period 7 April to 19 May, when smolts and goosanders are most likely to coincide the average recorded per visit was 2.8 adult birds.

The types of goosander observed from early April to the end of May are shown in Figure 9. The last male was seen on 27 April though redheads were recorded until 19 May. The first chicks were seen on 12 May, a single brood, shown in Image 3. A brood with female, probably the same birds, were also seen on 16 and 17 May.

In contrast to Usk town, goosanders were intolerant of observation, even distant. Not all flew off; some which may have been residents and so perhaps familiar with the observer, used the current to take them downstream. Nonetheless, it was rare to see goosanders obviously hunting. On 5 February, a pair (male and female) were seen hunting in the lower reaches of the Olway Brook. A pair was flushed here again on 23 March and 4 April though not seen feeding. A single redhead was seen hunting in water about one metre deep on the main river on 7 March when flows were at their lowest for the month. On 8 May, when flows were much lower, two types of feeding behaviour were seen. A single redhead was observed chasing cyprinid fry in slow, shallow water on the edge of a pool; a heron was also hunting there. Elsewhere, two redheads were persistently chasing unknown prey, probably salmonids, in the deeper water of a pool, repeatedly coming briefly to the surface to breathe before diving again, effectively doing tumble turns. On 12 May, three redheads were seen hunting together in fairly shallow water, less than a metre deep, adjacent to a strong current.

4. Discussion and conclusions

4.1 River conditions and timing of the smolt run

Based on water temperature and other observations, Mawle (2019) concluded that smolts would probably have been migrating through Usk during the second half of April and the first week in May in 2018 and 2019. In 2020, water temperature at Trostrey, and at Trallong upstream of Brecon (NRW, pers. comm.), consistently exceeded the threshold temperature of 10°C on 4 April, about two weeks earlier. The smolt run is therefore likely to have begun earlier in 2020. Nonetheless, there were still smolts migrating in late May: a shoal of about three hundred smolts was seen in the tidal reaches at Newbridge (NGR ST 384 948) by Ian Jones, NRW, (pers.comm.) on 21 May. Smolts may therefore have been migrating through Usk and Llangybi from early April to the end of May. The migration period is likely to have been drawn out by the sustained low flows. There was a small rise on 30 April to about 1,500 Ml/d at Trostrey, though about a tenth of this peak was abstracted at Prioress Mill (Dwr Cymru Welsh Water (DCWW), pers. comm.). For operational reasons, DCWW felt unable to comply with a request to leave it unabstracted to aid the migration. However, the sustained regulation release by DCWW of just over 55Ml/d from Usk reservoir that started on 13 May could have helped migration at least to Prioress Mill pumping station just upstream of Usk town. It may have affected migration downstream as well though how is less clear. There was usually a four-hour period, from about 1700 hours each day, except on the weekend, when pumping ceased. Consequently, flows downstream increased for a period before dropping back. How the smolts react to this is not known.

4.2 Bird abundance, seasonality and potential predation on smolts

As in 2018 & 2019, the predominant fish-eating birds recorded at Usk town were goosanders with few cormorants. More cormorants were recorded about three kilometres downstream of the town at Upper Llangybi, but again goosanders were more abundant.

Numbers of goosanders at Usk town were lower in February 2020 compared to the last two years, probably due to the extreme high flows. Even when flows were much lower, in April and May, there were fewer adults recorded: about three per visit on average over about half a kilometre of river, compared to about six per visit in 2018 and 2019 (Mawle, 2019).

The longer recording period at Upper Llangybi showed abundance to be much lower from November to January than from February to early May. This suggests that if the counts for the Usk commissioned by NRW for 2020 were restricted to the winter, they could substantially underestimate goosander abundance, and potential predation, during the smolt run in the spring. That assumes the lower Usk is representative of the catchment as a whole which it may not be.

The greater abundance of goosanders at Llangybi in February, compared to Usk town, during very high flows may reflect the available habitat. At Llangybi, there were flood pools on both banks as well as backwaters with limited current.

The lower abundance of goosanders and cormorants (on the water) before February at Llangybi may reflect the lower availability of prey at this time. There are few young salmon nowadays resident in this part of the Usk. The trout population is dominated by mature fish (Mawle, 2013) and most migrate to spawning tributaries and perhaps the upper river in the autumn, returning some time before March. New recruits, mostly trout in their third year, around 23-25 cm, do not usually arrive until April or May, around the time of, perhaps a little before, the salmon smolt run. Dace (*Leuciscus leuciscus*) are not as abundant as previously in the Usk, and are expected to retreat to winter refuges, such as the lower reaches of the Olway Brook where both goosanders and cormorants were seen feeding. Larger chub (*Squalius cephalus*) of a kilogram or more tend to remain in the main river but are not numerous and most will be too big for a goosander, if not a cormorant (Russell et al, 1996). The likely availability as prey in winter of other local species is unknown, including minnow (*Phoxinus phoxinus*), stickleback (*Gasterosteus aculeatus*), bullhead (*Cottus gobio*), stoneloach (*Barbatula barbatula),* eel (*Anguilla anguilla*) and small flounder (*Platichthys flesus*). Shoals of sticklebacks have been seen stranded on the river bank by receding winter flood water.

In the spring, the recorded density of goosanders was lower at Llangybi than at Usk town. Although the average of three adult birds per visit in April and May was similar, recording was over about a kilometre, roughly double the stretch counted at Usk. However, visibility at Llangybi is poor due to the extensive river bank vegetation so the counts will be a minimum indicator of abundance, even more so than at Usk town.

As in 2018 and 2019 (Mawle, 2019), male goosanders were not recorded after the first half of May. Most seem to have left earlier in 2020 perhaps due to the exceptionally warm, dry spring. The last male recorded at Usk town was on 4 May, after several visits without one present. The last male goosanders recorded in 2018 and 2019 were on the 9 and 19 May respectively. The last male recorded at Llangybi in 2020 was even earlier on 27 April.

As discussed by Mawle (2019), the potential impact of goosanders on salmon smolts will be determined by a number of factors including their diet, the extent to which the adult birds and the smolts coincide ('period of potential predation'), and bird abundance during this time. It is not clear that the newly-hatched chicks, or perhaps even the female guarding them, will feed on smolts, hence the focus on adult birds. The period of potential predation on smolts in 2020 is expected to have run from 4 April, when the water temperature exceeded 10°C, to the date when the last redhead without chicks was recorded, on 13 May at Usk and 19 May at Llangybi. The period of potential predation in 2020 is therefore about 45 days, roughly double the 21 days used to estimate the impact of predation by Mawle (2019). This counteracts the lower abundance, about half, of adult birds recorded in 2020 at Usk.

Predation by goosander on smolts in 2020 could therefore have been similar to that in 2018 and 2019. On the other hand, goosander density recorded at Llangybi was about half that at Usk in 2020, suggesting that the impact of goosander predation along the whole of the lower river could be less than estimated by Mawle (2019). Conversely, that estimate took no account of potential predation on smolts by cormorants in the spring, as present at Upper Llangybi. It is hoped that a clearer picture of goosander and cormorant abundance during the smolt run will be obtained if NRW extends the recording period on the Usk of its commissioned winter survey into May 2021.

Acknowledgements

My thanks to Chris Brain who made observations at Usk town, as in 2018 & 2019; to Ian Jones, NRW, for his observation on smolts; and, as ever, to Natural Resources Wales for providing data on flow and temperature.

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Image 1: The river Usk at Usk town. Observations were made of fish-eating birds between the old railway bridge at the top of the picture and the Bell Pool on the bend at the bottom. The central A472 road bridge is at NGR SO 374 007.

Image 2: 2 March 2020: A male and female goosander with other waterfowl on flood pools at Llangybi.

Image 3: A female goosander guarding a brood of ten chicks on 12 May2020 at Upper Llangybi.

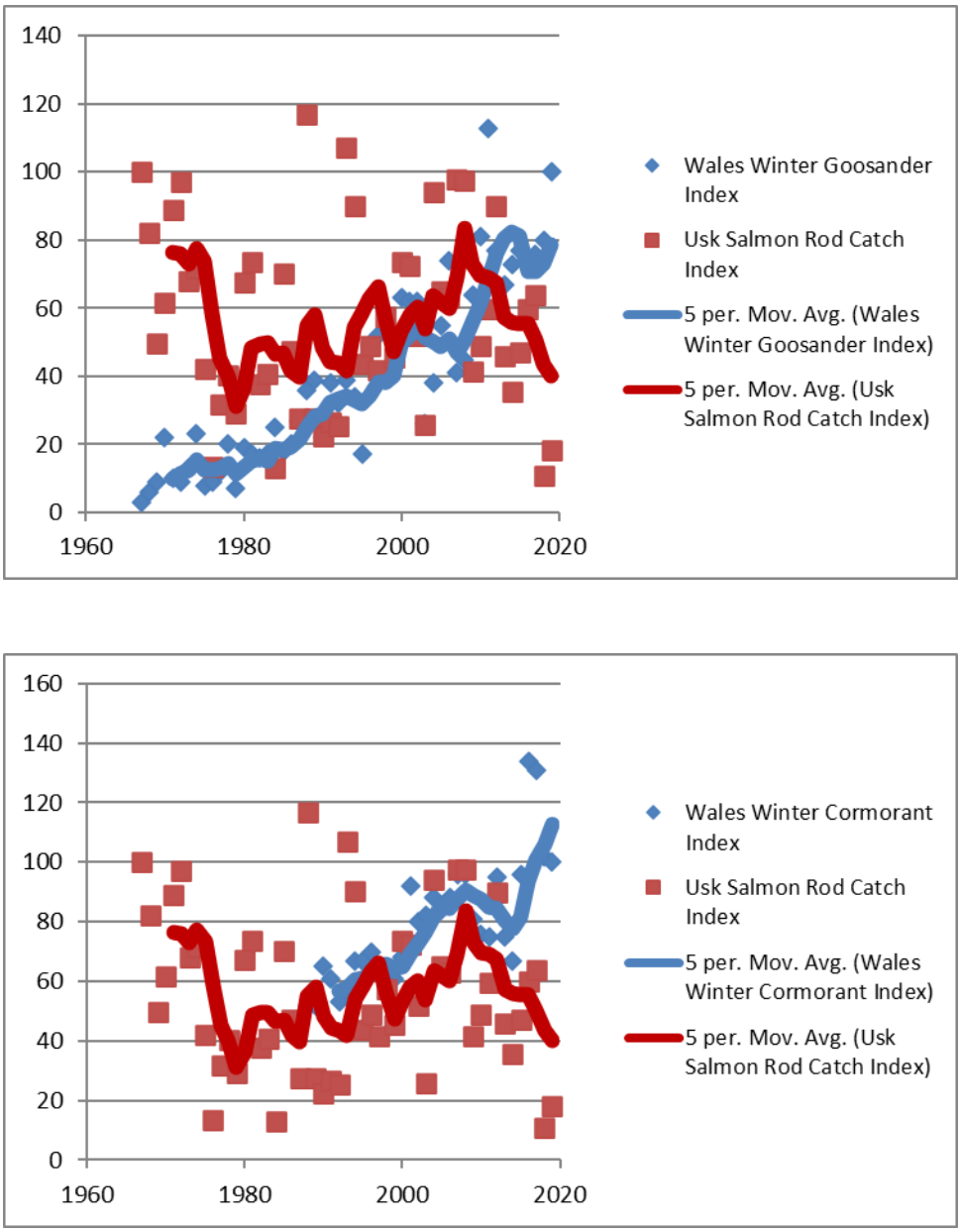

Figure 1: Indices of abundance of (i) Usk salmon, Rod catch 1967 =100; (ii) Winter Goosander in Wales; and (iii) Winter Cormorant in Wales; for birds 2019 count =100 from Frost et al (2020):

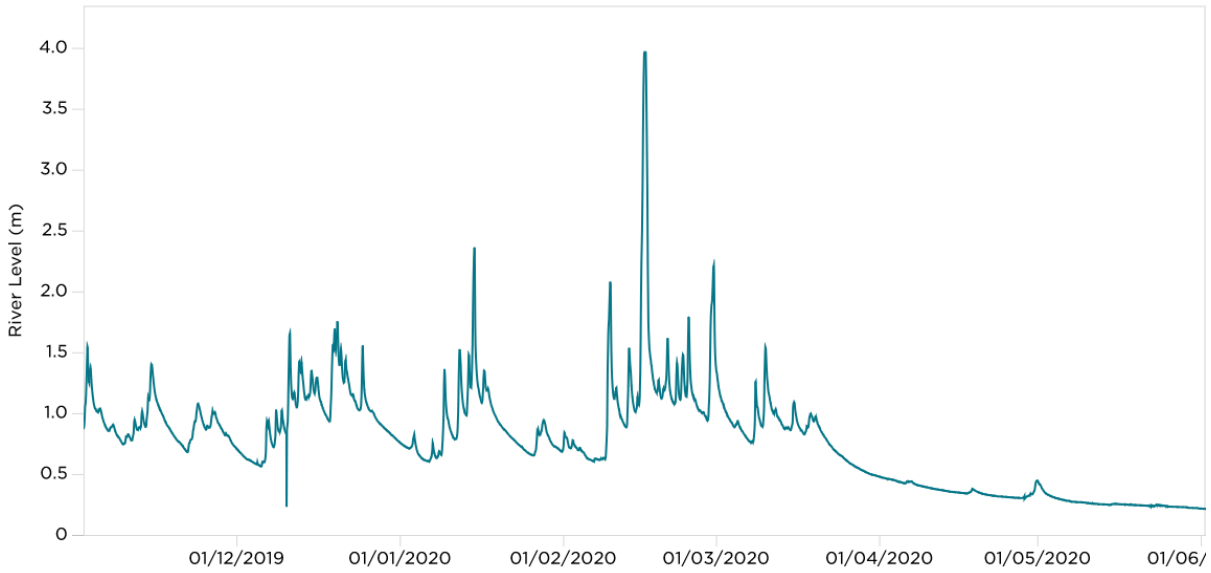

Figure 2: Daily mean gauge heights on the river Usk at Trostrey, near Usk, November 2019 to 1 June 2020. Image from: https://rivers-and-seas.naturalresources.wales/Station/4039?parameterType=1

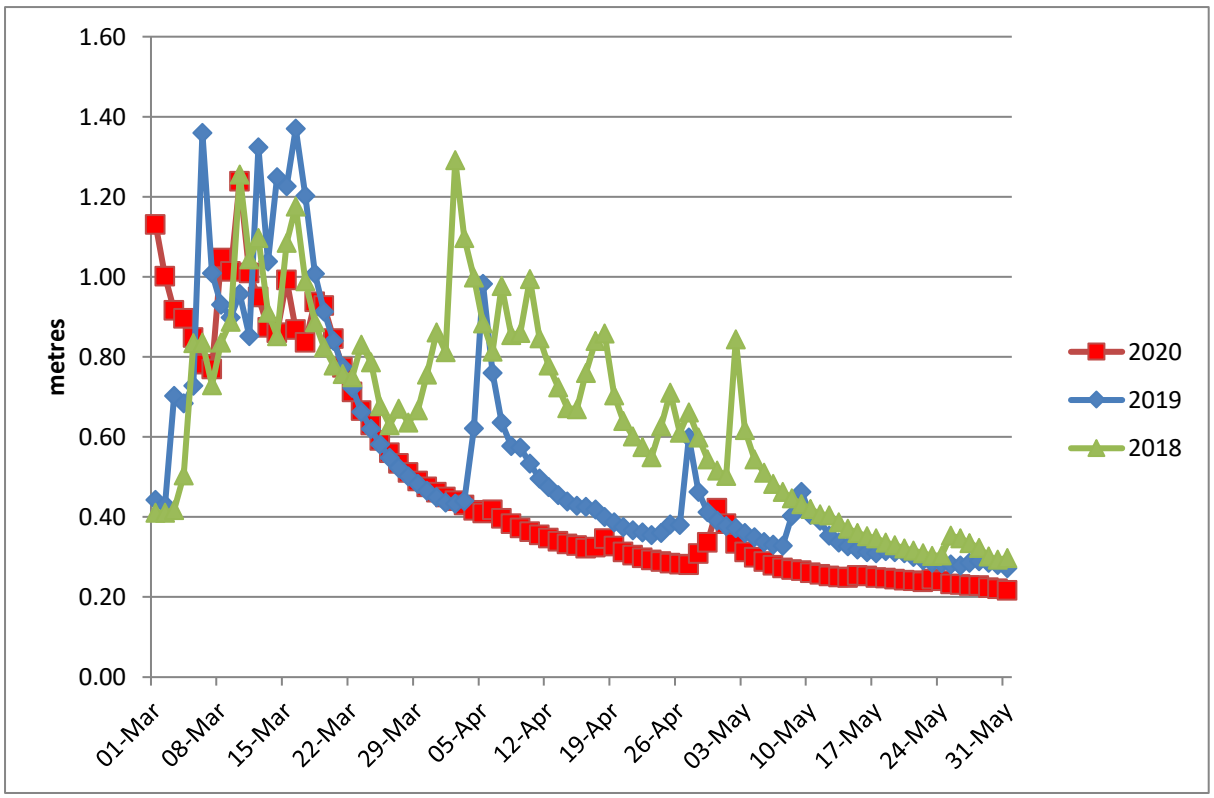

Figure 3: Daily mean gauge heights on the river Usk at Trostrey, near Usk, 1 March to 1 June in 2018, 2019 and 2020. (NRW data).

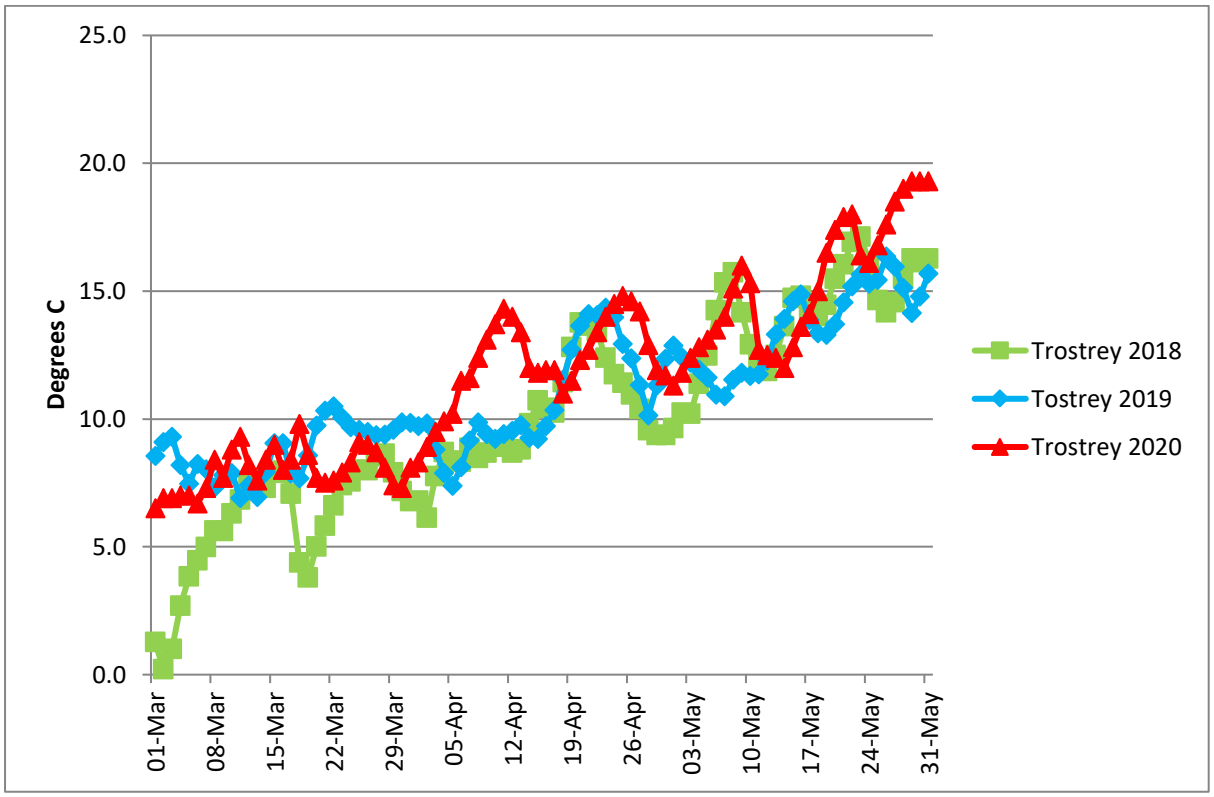

Figure 4: Daily mean water temperature on the river Usk at Trostrey, near Usk, 1 March to 31 May in 2018, 2019 & 2020 (NRW data).

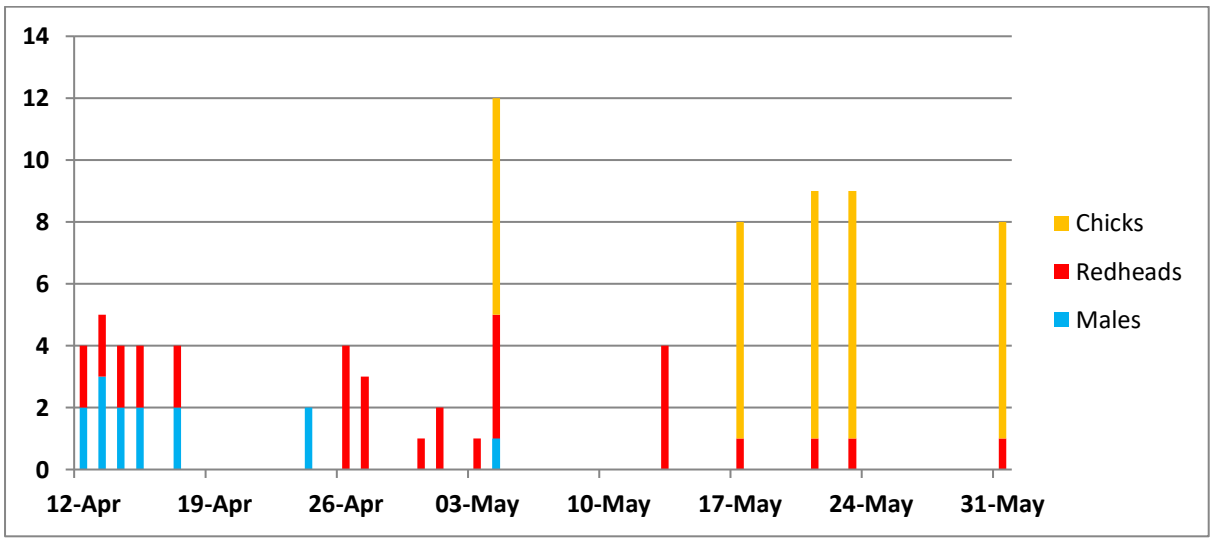

Figure 5: Types of goosander recorded on the River Usk at Usk town from 7 April to the end of May 2020.

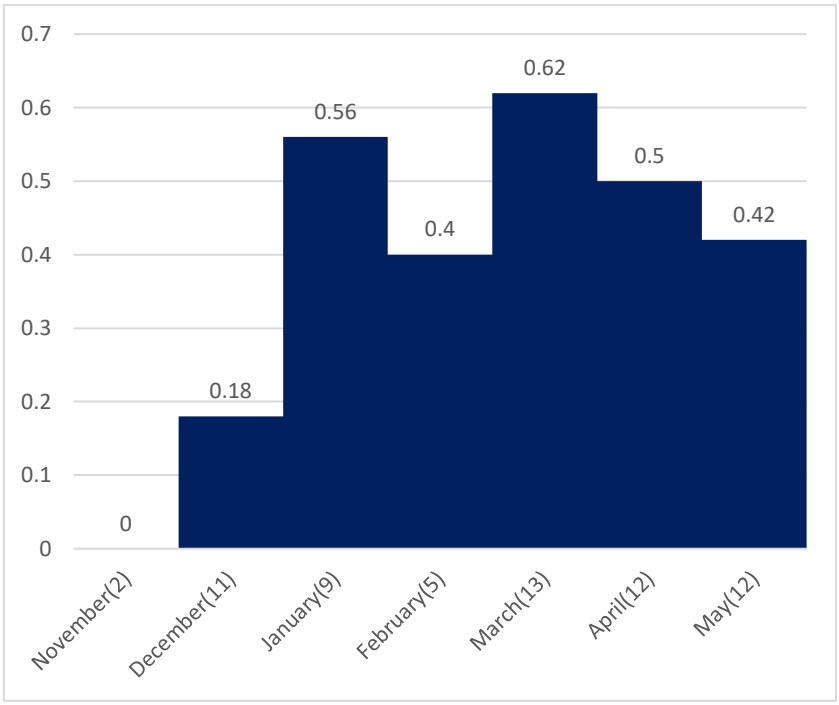

Figure 6: The average number of cormorants recorded per visit to Upper Llangybi each month from November 2019 to May 2020. The number of visits per month is given in brackets.

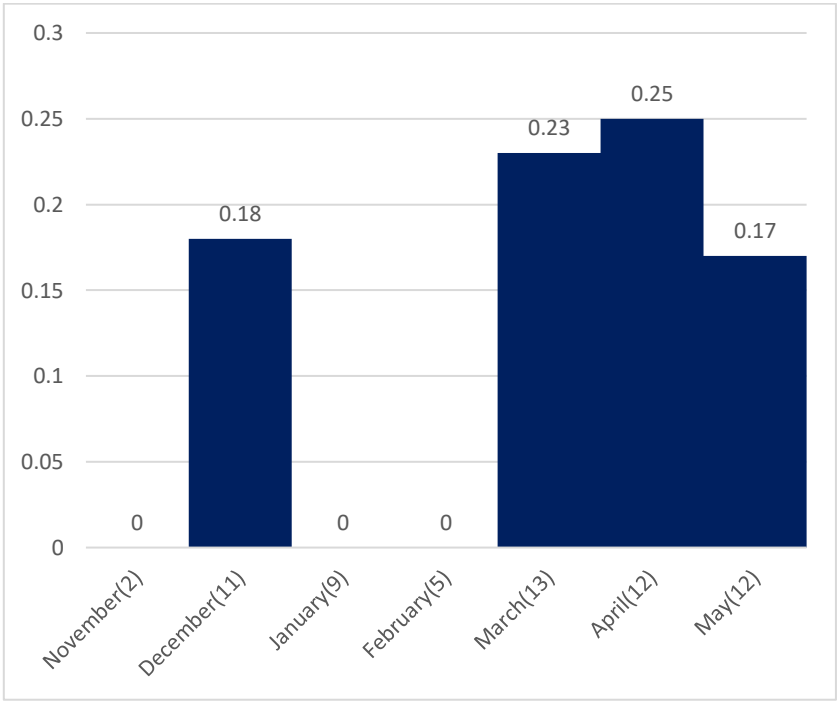

Figure 7: The average number of cormorants, not flying, recorded per visit to Upper Llangybi each month from November 2019 to May 2020. The number of visits per month is given in brackets.

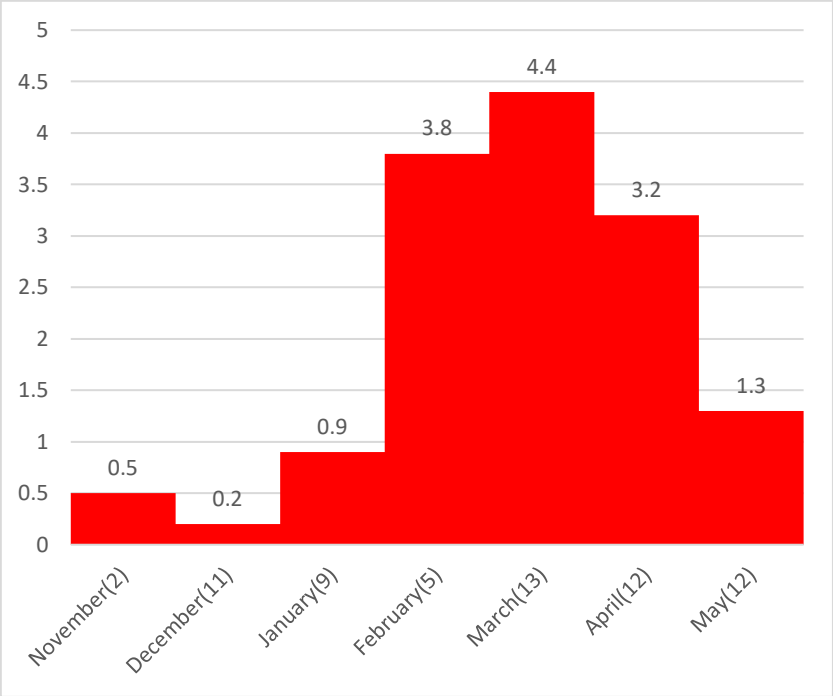

Figure 8: The average number of goosanders recorded per visit to Upper Llangybi each month from November 2019 to May 2020. The number of visits per month is given in brackets.

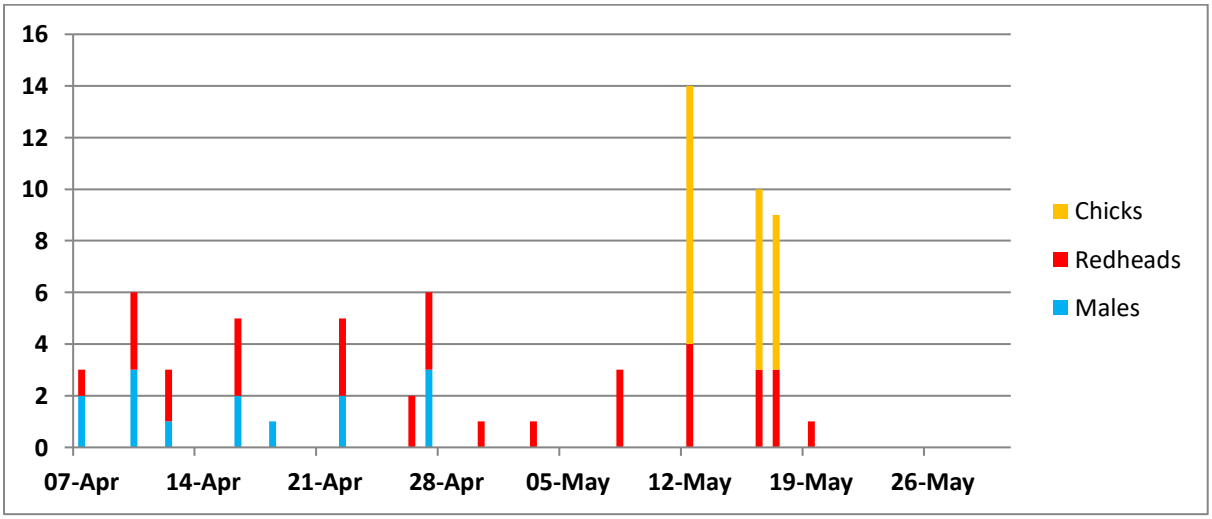

Figure 9: Types of goosander recorded on the River Usk at Llangybi from 7 April to the end of May 2020.

Date	Adult goosanders	Males	Redheads	Chicks	Cormorant
01-Jan	3	1	2		
24-Feb	2	1	1		
04-Mar	4	2	2		
06-Mar	4	2	2		
10-Mar	3	2	1		
11-Mar	2	1	1		
12-Mar	4	2	2		
18-Mar	1	1			
19-Mar	1	1			
11-Apr	5	5			
12-Apr	4	2	2		
13-Apr	5	3	2		
14-Apr	4	2	2		
15-Apr	4	2	2		
17-Apr	4	2	2		
24-Apr	2	2			
26-Apr	4		4		
27-Apr	3		3		
30-Apr	1		1		
01-May	2		2		1
03-May	1		1		
04-May	1	1			
04-May	4		4	7	
13-May	4		4		
17-May	1		1	7	
21-May	1		1	8	
23-May	1		1	8	
31-May	1		1	7	

Table 1: Records of goosanders and cormorants made by Chris Brain at Usk town in 2020

	Dates recorded				
Location	March	April	May	Total	Dates feeding
Island		**24,30**		2	2
Conigar	4,10	**17,26**	**1**, 4	6	3
Brittania	19	**27**	13	3	1
Bridge Pool	18		**31**	2	1
Dogger	**6,11,**12	12,14,15,**27**	**13**, 17,23	10	4
Bell			3,21	2	0

Table 2: Dates of recorded locations of goosanders at Usk town in 2020, with the number of days on which presence was observed and the number of dates (in bold) when observed feeding.

Date	Adult goosanders	Males	Redheads	Gender not determined	Chicks	Cormorants
23-Nov	1	1				0
29-Nov	0					0
03-Dec	0					0
07-Dec	0					0
11-Dec	0					1
13-Dec	0					1
15-Dec	0					0
16-Dec	2	1	1			0
20-Dec	0					0
21-Dec	0					0
26-Dec	0					0
28-Dec	0					0
30-Dec	0					0
05-Jan	1	1				0
11-Jan	0					1
15-Jan	0					1
17-Jan	0					0
19-Jan	2	2				0
21-Jan	2	1	1			0
24-Jan	1	1				3
26-Jan	0					0
27-Jan	2	1	1			0
02-Feb	0					1
05-Feb	2	1	1			1
11-Feb	5	4	1			0
25-Feb	4	2	2			0
26-Feb	4	2	2			0
02-Mar	4	2	2			2
03-Mar	3	1	2			0
05-Mar	6	2	4			0
06-Mar	5	3	2			0
07-Mar	4	2	2			0
08-Mar	14	4	3	7		0
11-Mar	5	2	3			0
13-Mar	2	1	1			1
17-Mar	3	1	2			1
19-Mar	1			1		2
21-Mar	1	1				1
23-Mar	5	3	2			0
25-Mar	4	2	2			1
01-Apr	0					1
02-Apr	2	1	1			1
03-Apr	4	2	2			0

07-Apr	3	2	1			0
10-Apr	6	3	3			1
12-Apr	3	1	2			0
16-Apr	5	2	3			1
18-Apr	1	1				0
22-Apr	5	2	3			0
26-Apr	2		2			1
27-Apr	6	3	3			1
30-Apr	1		1	1		
02-May	0					2
03-May	1		1			0
07-May	0					2
08-May	3		3			1
12-May	4		4		10	
16-May	3		3		7	
17-May	3		3		6	
19-May	1		1			
21-May	0					
24-May	0					
28-May	0					
30-May	0					
01-Jun	0					

Table 3: Records of goosanders and cormorants made by Guy Mawle at Upper Llangybi from November 2019 to June 2020.