

LIFE Oxyura Technique Assessment Report 2022

Techniques implemented and results



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05 avril, 2023

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Preface

This national assessment is carried out in the framework of:

- Recommendation n° 185 of the Berne Convention Permanent Committee, adopted 18 November 2016, on the eradication of the ruddy duck (*Oxyura jamaicensis*) in the Western Palearctic by 2020 (Council of Europe 2016).
- EU regulation n° 1143/2014 concerning the prevention and management of alien invasive species (AIS) introduction and propagation (Council of Europe, 2014).
- The 2015-2025 national plan to eradicate the ruddy duck, validated by the Water and Biodiversity Directorate on 24 June 2016 (Ministère de l'Écologie du Développement Durable et de l'Énergie, 2016).
- The implementation of the EU AIS regulation listing the ruddy duck as a species of concern for the European Union, transcribed into national law by Decree n° 2017-595 of 21 April 2017 regarding the control and management of the introduction and propagation of certain animal and plant species, and the Decree of 14 February 2018 regarding the prevention of the introduction and propagation of alien invasive animal species in Metropolitan France.
- The national strategy on AIS, Axis II “Operations for the management of gestion species and restoration of ecosystems”, Objective 5 “Control widespread alien invasive species”, Action 5.3 “Implement national combat plans”.
- The EU project LIFE Oxyura, led by the OFB in partnership with the SNPN, which lasts from October 2018 to December 2023. This financial instrument strengthens past actions in order to achieve two objectives: eradication of the population in the wild by 2025 and control and eradication of the captive population by 2030 (European Commission, 2018).

This assessment report covers the period from the 1st of January to 31 December 2022. The information it contains is derived from the results of censuses, field surveys and destruction operations carried out by the OFB and the SNPN - Grand-Lieu RNN. Concerning observations outside of Grand-Lieu Lake, this assessment report is also based, to a large extent, on information gathered from the naturalist community, in particular through regular consultation of the ornithological data of the Visionature network.



1 Background

1.1 A conservation issue for the white-headed duck

The LIFE Oxyura project responds to a conservation issue of a diving duck species, the white-headed duck - *Oxyura leucocephala* (European Commission, 2018). This species range is subdivided in two geographically isolated populations. One of them, located in the western Mediterranean, is threatened (Green & Hughes, 1996; Hughes et al., 2006). Currently only present in Spain and to a lesser extent in Morocco and Tunisia, it used to nest in Italy and France, the last sedentary pair being observed in Corsica in 1966. In 1977, the population was close to extinction, with 22 individuals recorded in southern Spain. Conservation measures have enabled it to recover, with a fairly stable population of around 2,500 individuals. This increase is associated with occasional sightings of isolated birds in France since the 1980s. (Figure 1).

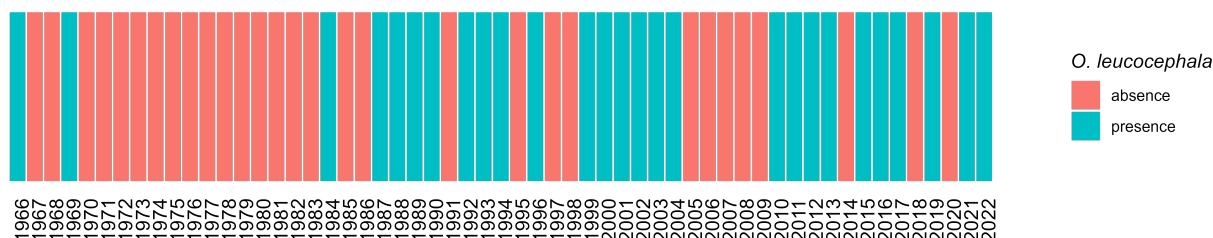


Figure 1: Evolution of the white-headed duck presence in France

The Iberian white-headed duck population faces a new threat since the introduction of a closely-related species, the ruddy duck - *Oxyura jamaicensis* (Gutiérrez-Expósito et al., 2020). This species, native to North America, is a potential competitor for nesting sites and food resources. Although they probably diverged genetically 1-2 million years ago (Muñoz-Fuentes et al., 2007), these two species nevertheless produce fertile hybrids, of which 69 specimens have been observed in Spain since 1991 (Gutiérrez-Expósito et al., 2020). This genetic introgression would likely lead to the extinction of the Iberian white-headed duck population in favour of a hybrid population or a new nucleus of ruddy duck. This transition could be rapid due to the aggressive behaviour of male ruddy ducks during the breeding season, favouring their access to female white-headed ducks (Figure 2) (Gutiérrez-Expósito et al., 2020).



Figure 2: Two males in breeding plumage fighting in Mayenne - France; a ruddy duck to the left, a white-headed duck to the right. © Eric Médard

In view of conserving the white-headed duck, the Spanish authorities carried out a systematic campaign to destroy ruddy ducks and hybrids in their territory until 2007. Since then, a few occasional sightings have been made¹. Initially introduced in the UK, the threat of the ruddy duck returning to Spain cannot be ruled out as long as the species is still present on the European continent. Under pressure from the white-headed duck conservation issue, the British authorities in association with local ornithological organisations implemented an eradication plan in 2005², which reduced the population from 6000 individuals to 12 individuals in 2019 and 2020. Breeding in the wild was observed every year between 1953 and 2018, with 2019 marking the end of the population renewal (Henderson, pers. comm.). However, two small nuclei have been established on the continent, one in France remaining at around 200 individuals between 2004 and 2018 thanks to the efforts of the French Biodiversity Agency (OFB) and the French National Nature Protection Society (SNPN), and one in the Netherlands of around 80 individuals³. In order to prevent natural breeding in France, the LIFE Oxyura project, led by the OFB, was set up in 2018 to support the 2015-2025 national management plan. In particular, it enabled the hiring of four officers specifically to control the ruddy duck throughout France for five years (European Commission, 2018).

¹The last three sightings date from 2011, 2014 and 2020, respectively

²The plan was set up after a 5-years research phase

³Some birds have been observed in Belgium, but are not corresponding to an entire population

1.2 The ruddy duck in brief

The ruddy duck is a small duck with a long tail cocked at 45°, which is characteristic of the *Oxyura* genus (Figure 3).

- Length : 25-43 cm
- Female weight : 450-845 g
- Male weight : 500-700 g



Figure 3: A pair of ruddy ducks in summer. © OFB

The male's plumage is predominantly red with a black head and white cheeks (Johnsgard & Carbonell, 1996). The bill is blue in the breeding season. The female has brown plumage with dark brown on the upper parts of the head and darker-striped light brown on the lower parts. The undertail feathers are white. Regardless of sex, the C-shaped bill of the ruddy duck is the main feature distinguishing it from the white-headed duck, whose bill is S-shaped. Juveniles have a similar profile to the female and can be mistaken for young common pochard. In its native range, the ruddy duck winters on large, shallow bodies of water (coastal bays or lowland lakes). Its preferred nesting sites are smaller bodies of water with extensive riparian vegetation consisting of sedges, reeds and willow saplings. The ruddy duck feeds on aquatic plants, molluscs, worms and insects (Sanchez et al., 2000; Woodin & Swanson, 1989). Midge larvae and nymphs (*Tendipedidae*), specifically *Chironomus*, are the primary food sources during the breeding season (Siegfried, 1973).

2 Management methods

2.1 Management methods adapted to the biological life cycle

2.1.1 Insights into the biological life cycle of the ruddy duck in France ⁴

A ruddy duck population has been established in France since 1974. At the onset of the first cold weather, most of them gather as from late November on Grand-Lieu Lake, in the Loire-Atlantique department, to spend the winter. They form part of a group of about 20,000 wintering ducks of various species in the central area of the lake (Figure 4). This period is favourable for estimating the size of the French population as almost all the birds are visible at this site.

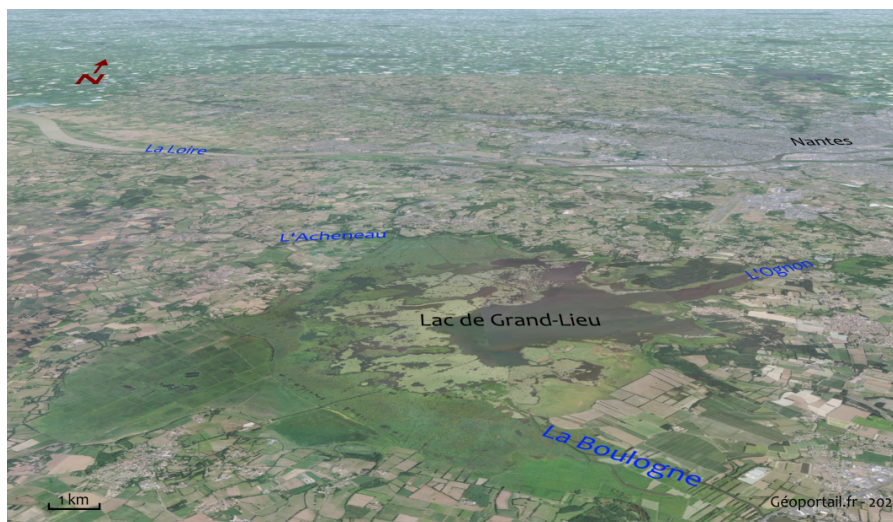


Figure 4: Geography of Grand-Lieu, a lowland lake in western France (47° 05' 45" N, 1° 40' 3" W). The lake has two tributaries, the Boulogne and the Ognon, and flows into the Acheneau which in turn flows into the Loire. The light green areas are water lily beds which disappear in winter. © Geoportail

The ducks move from the east to the west of the central area of the lake, depending on the wind and the disturbance caused by any predators present or the few professional fishermen (Figure 5). Until mid-February, the birds stay away from the edges of the lake and show fleeing behaviour as soon as they are approached within 500m.

⁴The information in Section 2.1.1 is based on observations made by staff from the Grand Lieu SNPN and French Biodiversity Agency, as well as by bird watchers and professional ornithologists.



Figure 5: Area where ruddy ducks spend the winter (blue) - Location of hides (orange) - Location of the calling cage (red). © Geoportail

From mid-February onwards, in good weather, the ruddy ducks show the first signs of breeding behaviour. They then move closer to the banks, particularly in the coves beside the riverine woodland to the north of the wintering area and around the islands to the west (Figure 5). The males acquire their breeding plumage in late winter without forming pairs. Only part of the population remains on Grand-Lieu to breed, the rest gradually moving to smaller ponds, mainly in the north-western quarter of France. The maximum dispersal of the birds is unknown⁵. It is therefore not ruled out that there are also connections with the other European populations (notably the Netherlands one).

The first nuptial displays are observed in late winter, when the weather is mild. The male calls throughout the breeding season, which lasts until the end of summer, both day and at night (S. Reeber & A. Laroche, pers. comm.). This call is very characteristic and thus enables the species to be identified. Ruddy ducks make their nests in the vegetation, for example in sedge clumps. They often lay eggs in the nests of other duck species. The first chicks are seen in May at the earliest, but the breeding peak is usually around early July.

The location of the ducks during moulting after breeding has not been clearly identified. On the one hand, the sudden gathering of the population at the wintering site suggests the existence of a potential site where the ducks gather to moult (see analysis in Appendix A). On the other hand, a few individuals located during the same period at very distant sites suggest that the birds moult, camouflaged, close to their nesting site in the vegetation. The moulting behaviour of the native North American population is also poorly identified

⁵In the British island context, maximum dispersal appears to be about 150km, but continental European birds are known to have originated from the founder population in England

(Baldassarre, 2014). Males appear to moult as early as August, after breeding. Some have been seen in large, open areas. The main hypothesis for females is that individuals moult on the nesting sites camouflaged in the vegetation.

2.1.2 The winter strategy

The main difficulty in winter on the Grand-Lieu lake is getting close enough to the birds to have them within shooting range. For this purpose, several complementary tools are used. Investigations have shown that chasing them in boats combined with the use of guns is not very effective and above all counterproductive in terms of disturbing other species that find refuge on the lake in winter. The LIFE programme has enabled the construction of 3 hides positioned on the banks as close as possible to the area occupied in winter (Figure 5 and Figure 6). In windless conditions, these shooting stands are ideal for firing high-precision rifles capable of hitting targets at long distances (300m maximum). The area occupied by the birds during winter shooting campaigns is often far from the stands, so the birds must be moved. An unobtrusive boat can be used to gently bring the birds closer to the shooting stands (Figure 7). From mid-February onwards, playbacks⁶ combined with plastic decoys positioned near the shooting stands are used to attract the ducks.



Figure 6: One of the three hides built on Grand-Lieu Lake with funds from the LIFE Oxyura project. © OFB

⁶An audio system to transmit the sound of the males' nuptial calls



Figure 7: Unobtrusive boat with electric motor for gently bringing birds towards the shooting location. © SNPN

An alternative to shooting is capturing ducks with a cage trap. A bird can be lured either with food or by using fellow ruddy ducks. The first option is not selective and may disturb other species. It is also not very effective on ruddy ducks due to their diet, so the use of live decoys is favoured. In partnership with Branféré Zoo⁷, the Grand-Lieu SNPN and OFB are developing this approach (Figure 8). The English experience shows that cage traps are time-consuming to use. In order to minimize handling time, the cage developed within the LIFE framework is fitted with an automatic trap door that opens at regular intervals. Photographic traps transmit images by telephone before the trap doors are opened. If a ruddy duck is spotted, the team arrives before it opens to capture the bird.

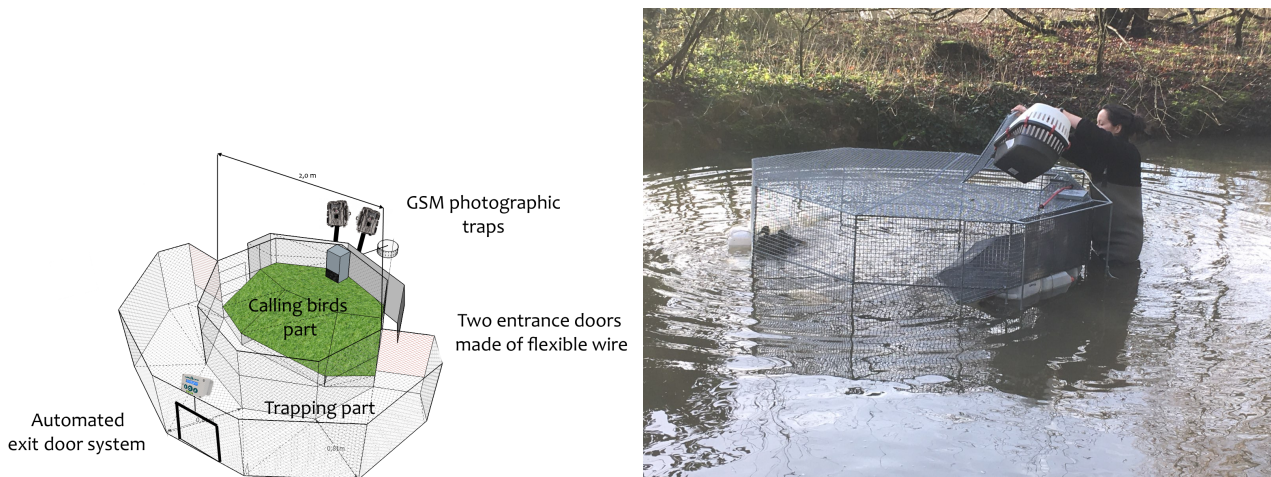


Figure 8: Calling cage under testing at Branféré Zoo. © Diagram: Jean-Marc Gillier, © Photo: Branféré Zoo

⁷Zoo located in Morbihan and member of the French Association of Zoological Parks (AFDPZ)

2.1.3 The summer strategy

Some of the birds nest on Grand-Lieu Lake from spring to the end of summer. The suitable areas vary according to water levels and are not very accessible. The most suitable approach is by boat from the centre of the lake. The males are often found near the nests on the edge of the vegetation and are an indicator of the presence of a female and her nest. Another method is to detect birds calling at night using a sound amplifier. Once the birds have been located, they are shot using a high-precision rifle from a boat stabilised by water lilies. Nests are also occasionally located during surveys in the riverine woodland. In this case, trap cages positioned on the nests are effective for capturing females (Figure 9).



Figure 9: Cage trap system on nests, here an example with a common pochard. © Alain Caizergues

As in winter, an alternative at Grand-Lieu Lake is to attract the birds. The sexual activity of the ducks can be exploited to attract them to the hides which are still situated in the water in spring. The combination of playbacks and ruddy duck-shaped decoys is the most attractive solution. Attempts to shoot with rifles fitted with silencers and night vision equipment are possible under favourable weather conditions (little wind and clear nights). In addition, the use of a calling cage is a solution considered throughout the summer season given the continuous sexual activity during this period.

At the end of winter, some birds leave Grand-Lieu Lake to nest in smaller ponds with suitable riparian vegetation. For this part of the population, the main challenge is locating them. The main detection method is regular surveying of historical sites of ruddy duck presence and potential nesting sites (Figure 10). Bird watchers and professional ornithologists observations are also used and are particularly useful for detecting birds outside the main range of ruddy duck in France. Once located, officers secure the area and adapt their approach to the birds and the shooting solution according to the local configuration.



Figure 10: Boat survey during the breeding season. © Valentin Boniface

2.2 Management of the captive population

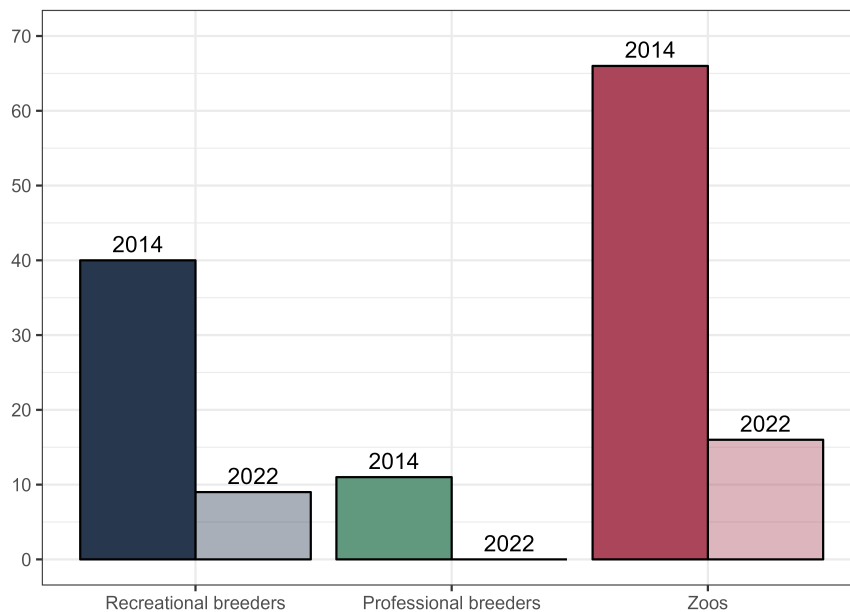
The previous study focusing on the captive ruddy ducks in France dates from 2014 with a total of 203 birds counted in 26 departments. Among these individuals, 103 were held by recreational breeders in 21 departments, 80 were detained by 10 zoos in nine departments and 20 were detained by six professional breeders in five departments. The current legislation, notably since the European regulation of the 14 February 2018 on the prevention and management of the introduction and spread of invasive alien species on the metropolitan territory, forbid the detention, transportation, sale or acquisition of the ruddy duck. Except for some zoos authorized to display captive ruddy ducks, breeders who previously detained individuals at this date were authorized to keep their birds until their death, if they declare their birds to the prefecture of their residency place before the 31 December 2019 and if they don't do any breeding (at least eggs destroyed).

In order to monitor the captive population evolution, a survey on the breeders identified in 2014 was conducted at the end of 2022. This survey was conducted among the departmental services of the OFB and among the Departmental Directions on Populations Protection (DDPP) of the departments where captive ruddy ducks were identified in 2014 or where previously unidentified owners were detected. Informations previously collected on ruddy duck detainers were thus actualized in order to conclude on the renewal of the captive population and its threat for the wild population (Figure 11).

We were able to collect information on 27 of the 48 establishments possessing ruddy ducks in 2014, including 16 recreational breeders, three professional breeders and eight zoos. On the other hand, two new recreational breeders were identified in 2022, detaining one and two individuals, respectively. Among those two, the second one did not report its acquisition and thus did not respect the legislation. It is thus likely that captive birds present on the French territory were not identified by this survey, even if they probably represent a low proportion of the total captive population.

The 27 establishments for which data were available for both years of the study represented 117 birds in 2014 for 25 in 2022. The majority of the ruddy ducks still captive in 2022 were detained by zoos for public display and sensibilisation, nine individuals being still detained by recreational breeders, while professional breeders did not possess any bird anymore (Figure 11). The captive population trend is thus strongly decreasing throughout the French territory. These numbers illustrate the overall good respect of the legislation, and the LIFE objective to eradicate the captive ruddy duck population by 2030 is likely reachable.

Ruddy duck numbers detained in captivity per sector
2022 and 2014 data



Source : OFB

Figure 11: Ruddy duck numbers detained in captivity per sector

On the other hand, the new legislation may led recreational breeders of diving ducks to turn to another species of the *Oxyura* genus. The lake duck, also called Argentine ruddy duck (*Oxyura vittata*), native from South America, may also hybridizes with other *Oxyura* species, and notably the white-headed duck. To date, it is difficult to estimate the number of captive lake ducks in France, but if some of them escape into the wild, they are likely to provoke, as the ruddy duck before, the same issues of genetic introgression in the white-headed duck. It is thus paramount to prevent this species introduction into the wild, notably by promoting new legislation or preventive actions.



Figure 12: Argentine ruddy duck, *Oxyura vittata*, male

3 Results in their historical context

3.1 Population status in 2022

At the beginning of 2022, the number of ruddy ducks reached 59 individuals on Lake Grand Lieu⁸. The trend is a increase of 321% compared to the previous winter. We have to go back to 1997 to find similar numbers (Figure 13).

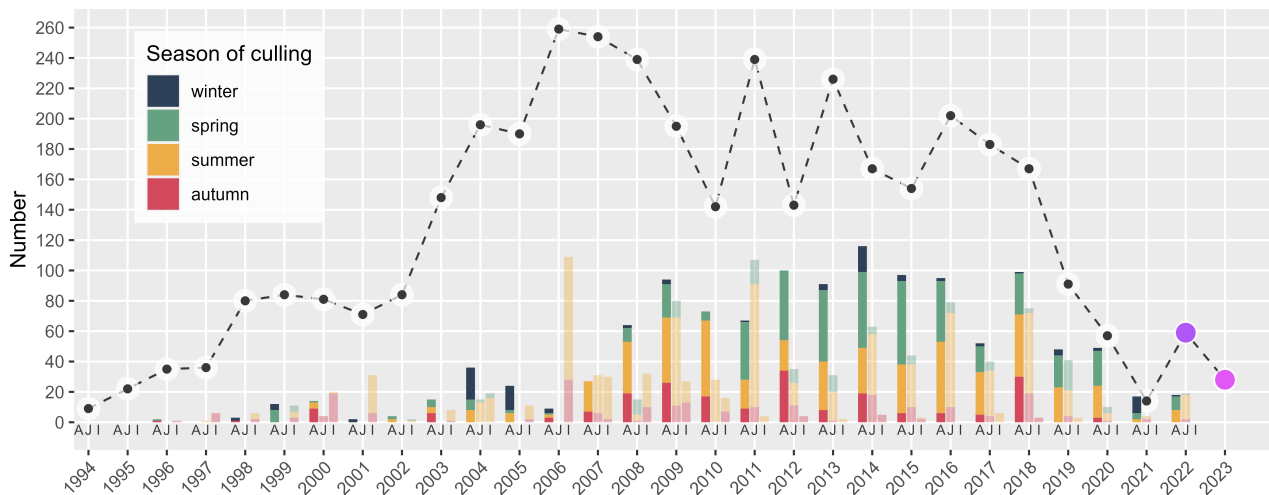
Size of the French wintering population inferred from the numbers culled

- In dots : Number of wintering individuals (until the 15th of January)

- A : Number of culled adults

- J : Number of culled juveniles

- I : Number of culled individuals with undetermined age



Source: SNPN & OFB

Figure 13: Numbers of the French wintering population with respect to the numbers culled. Numbers before culling in mid-January 2022 in purple, and numbers of the resulting population in mid-January 2023 in pink.

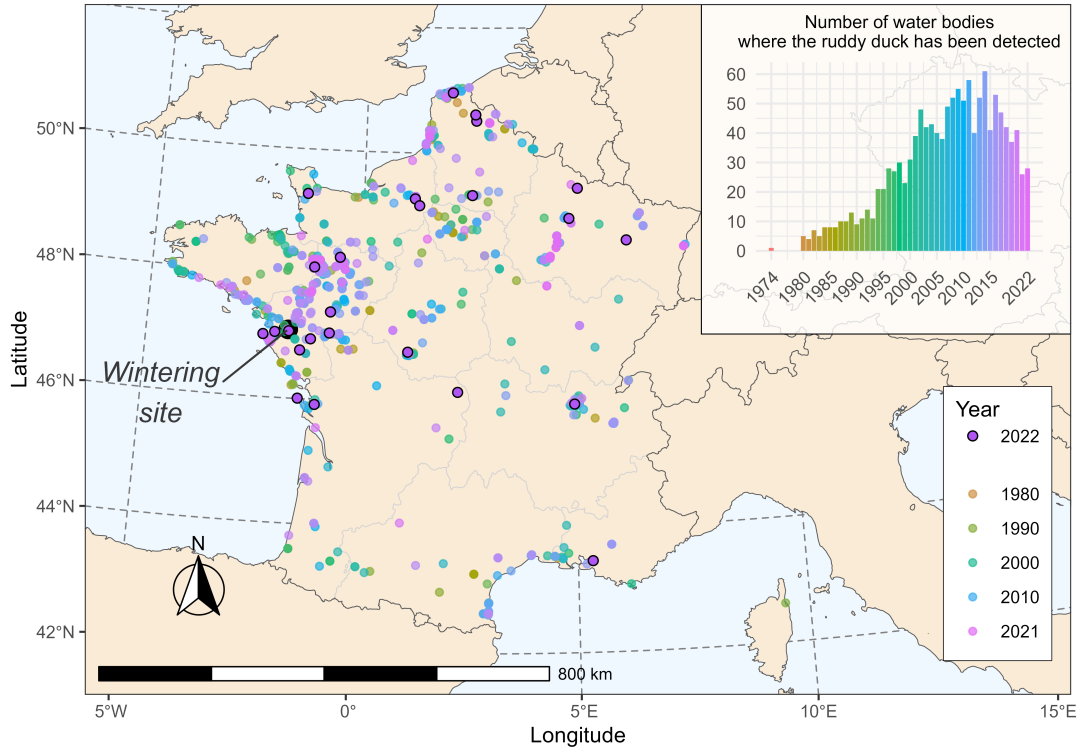
After the 2021-2022 wintering period, ruddy ducks were observed at 28 sites, 2 more than the previous year (Figure 14). This result is coherent with the wintering numbers trend. These sites are located in the same areas as in previous years (See details per department in Appendix B).

⁸A few isolated individuals can be observed elsewhere in France, but they do not necessarily belong to the French population and are therefore not taken into account here



Spatial evolution of the ruddy duck French population

A point represents a detection site



Source: Faune France, SNPN & OFB

Figure 14: Trends in spatial range of ruddy ducks - See the **interactive map** for the historical details of the sites.

3.2 Detection and culling in 2022

Continuous work is carried out by the LIFE project field officers who survey potential bird habitats throughout the year. Online ornithology platforms⁹ are also routinely consulted to detect part of the birds. This partnership is essential because the birdwatching community covers the whole of France and allows for the rapid recognition of new areas. Finally, the officers from the OFB's departmental units assist this detection work by transmitting information during their field missions.

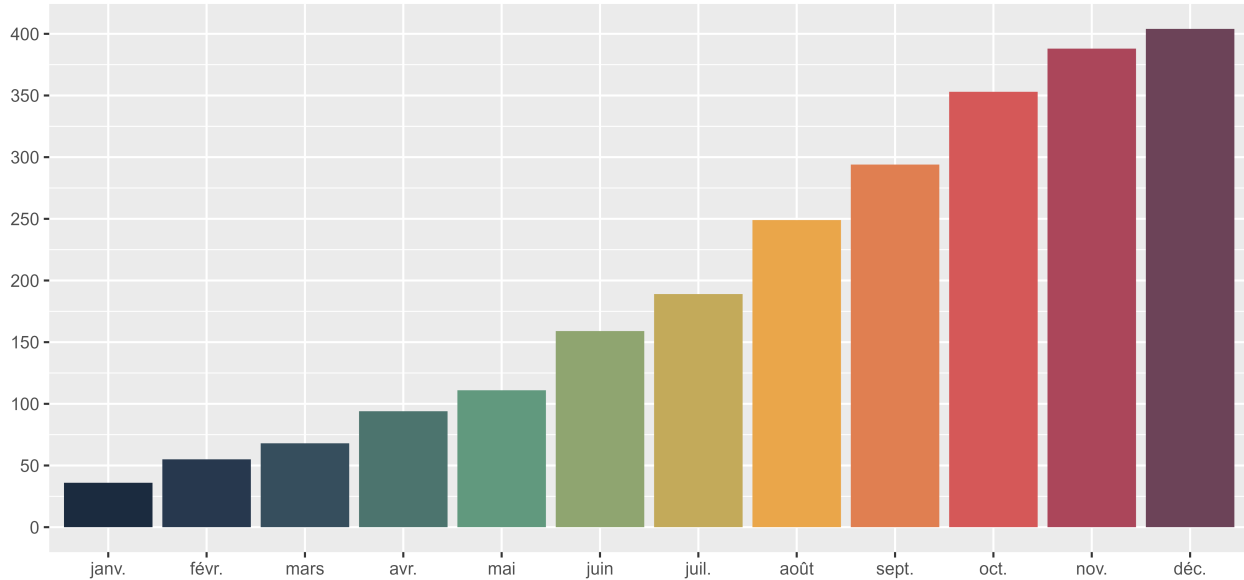
Surveys by LIFE officers were divided as follows: 2/3 monitoring of historical sites of ruddy duck presence, 1/3 exploration of sites with high presence potential. This year, LIFE officers made 404 visits to 96 sites (Figure 15).

⁹<http://www.faune-france.org> - <http://www.observation.org> - BDBiodiv



Cumulative number of surveys in 2022

Note: a same site is often visited more than once in the year



Source: OFB

Figure 15: Cumulative number of surveys in 2022.

From the observation data derived from the various sources available, the number of birds actually detected without the breeding period is looked for¹⁰. To make this estimation, we assume that two successive observations of a ruddy duck¹¹ on the same site correspond to two different individuals if over one month has elapsed between observations. Naturally, major sources of error¹² result in an uncertain estimation. However, this approach remains the best indicator of bird detectability outside the wintering period.

Using the method described above, we estimate that 106 different individuals were detected. Among these, 31 adults of which 14 males and 17 females. The remaining 75 individuals were juveniles or individuals of undetermined age. The wintering population consisted of 59 individuals. The detection rate for adults that wintered in France is thus 53%¹³.

In parallel with detection, the culls performed by SNPN and OFB officers eliminated 37 individuals¹⁴, of which 18 were adults: 12 males and 6 females. The remaining 19 individuals were juveniles¹⁵ &¹⁶. The culling rate for adults that wintered in France is 31%. The culling rate for detected adults is 58%¹⁷.

¹⁰A ruddy duck may be observed repeatedly at a site by one or more bird watchers or professional ornithologists

¹¹Observations are considered to be potentially of one single individual only if the age and sex characteristics are identical

¹²There are two sources of error in this estimation of the number of birds detected: i) the time interval between two observations for which individuals are considered different, and ii) individuals that have travelled between several sites and are therefore counted as many times as they are detected

¹³A detection rate over 100% is not necessarily an error as it is likely that birds from a population not wintering in France are detected.

¹⁴During the autumn-winter period, juvenile birds are of adult size but with female plumage. Birds culled during this period are systematically sexed and aged by dissection

¹⁵Very few individuals are not retrieved and could be adults

¹⁶A higher number of juveniles culled than detected is possible due to the uncertainty in the estimation of the number detected

¹⁷We cannot estimate the effectiveness for juveniles because we do not have the number of young produced during the year

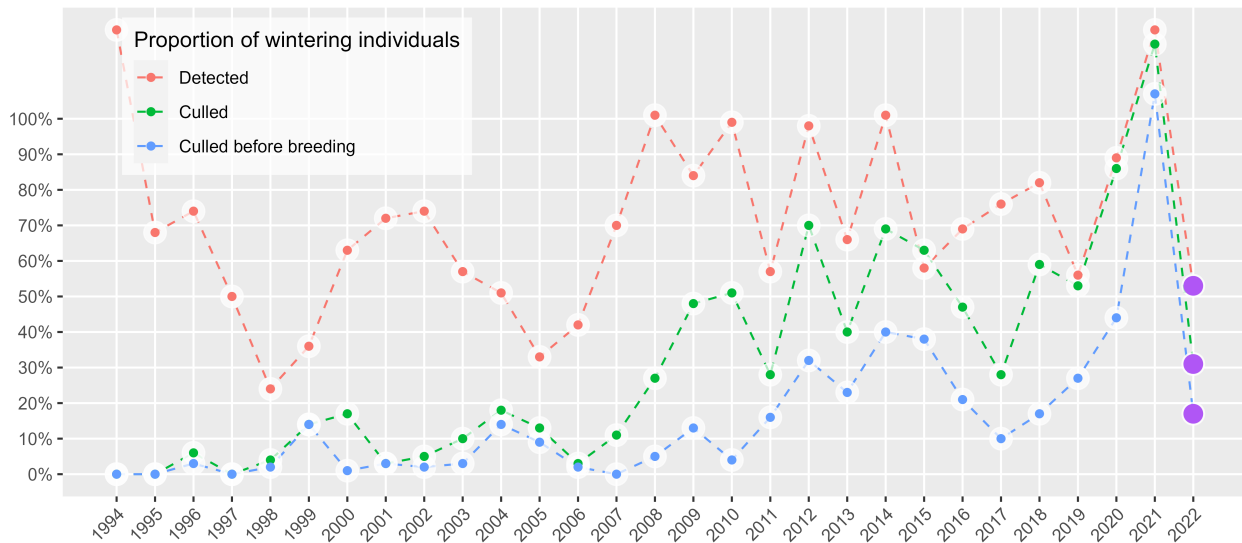
An interesting indicator is the proportion of adults culled before they have reproduced. Indeed, by definition, they have not had time to produce young and therefore contribute to population renewal, which has a significant impact on the decline in numbers the following winter. This rate of culling before reproduction amounts to 17%.

In order to make comparisons from year to year, the detailed culling time series is presented in Figure 13. Historical detection and culling efficiencies are presented in Figure 16.

Proportion of wintering numbers detected and culled

Detection data are estimates with associated uncertainties (see Section 3.2 for more details)

Culling before breeding is a key factor to decrease the population productivity



Source: Faune France, SNPN & OFB

Figure 16: Proportion of wintering numbers detected and culled. Please note that these figures are only estimates and therefore uncertain.

4 Discussion and perspectives

4.1 An encouraging trend threatened

The population decrease over six consecutive years demonstrates the effectiveness of the eradication actions set up in France. The sharp decrease observed the last four years allowed to reach a wintering population of six individuals on the Grand-Lieu lake at the beginning of December 2021. While the LIFE final objective was almost reached¹⁸, fifty birds arrived on the lake mid-December, explaining the rebound of the numbers counted during the 2021-2022 winter, and raising questions on the species dynamics.

The censuses performed during the 2021-2022 winter (59 individuals) on the Grand-Lieu site allowed to estimate the numbers of young in the population. Indeed, the ruddy duck sex-ratio is around 60% biased towards males for adults, and at equilibrium for young (Tableau et al., 2023). Using these data as well as the number of wintering males and females observed, we are able to estimate the proportion of juveniles among individuals presenting a female's plumage type in winter (which include young males and females of all ages). The wintering population in 2021-2022 thus seem to be composed of around 25% of young (*i.e.* 15), and thus of 75% of adults (*i.e.* 44; see Tableau et al. (2023) for more details). In comparison with the 14 birds observed during the 2020-2021 winter, this number of 44 adults would imply a survival of 300% between the 2020-2021 and 2021-2022 winters, which is strongly unlikely for this species (Tableau et al., 2023). This population increase thus excludes the possibility of an exceptional breeding the previous year but rather suggests that new individuals migrated from another population. In France, such a population should have been noticed by the national bird watching network composed of dedicated birdwatchers and professional ornithologists. Among other European populations, only the Netherlands one may be sufficiently important in term of reproductive dynamics and abundance to provide such numbers of individuals. The connection highlighted between populations thus induce that the ruddy duck management should be conducted at the European scale and highlight the importance of coordinating culling operations with other countries.

The breeding behaviour of the migrant birds raised questions for the evolution of the population in 2022. Would these individuals fly back to their former population or would they stay and reproduce on the French territory, and thus contribute to the renewal of the French population on the long term? The detection rate of wintering individuals was around 50% in 2022, which is significantly lower than other years of the LIFE project, while the sampling strategy remained the same. It thus seems that at least part of them flew back to their native population.

The resulting number of birds, *i.e.* the counts from the 2022-2023 winter, is half lesser than during the previous winter (28 *vs* 59 individuals) but remains above counts performed during the 2020-2021 winter (14 individuals). Taking into account the low culling rate of adults compared to the previous year (~30%), this sharp decrease in the number of ruddy ducks recorded comfort the hypothesis that at least some of the migrant birds went back to their native area.

4.2 A response of the LIFE project adapted to ongoing changes

The efficiency of the LIFE program in 2022 is difficult to evaluate, due to the arrival of migrant birds during the 2021-2022 winter. Indeed, the effect of culling operations may be confounded with the departure of birds staying only temporarily on the Grand-Lieu lake during winter. If all the migrant birds arrived during winter flew back to their native area, the culling rate in 2022 is lower than for other years and the population is increasing. On the opposite, if all the migrant birds then stayed to breed on the French territory, the culling rate is comparable

¹⁸Taking into account numbers recorded before the beginning of the LIFE project, the aim was to reach a population of less than 10 individuals before the end of 2023.

with those of previous years. While the real situation is likely between these two scenarios, with part of the migrant birds staying and part leaving, it is nevertheless impossible to determine in which proportion.

When comparing the culling rate to the detection rate (53% of individuals detected for 31% culled), the culling efficiency during the 2022 year is lower than other years of the LIFE project (culling rates above 50% during other years, and almost equal to detection rates). This apparent decrease of efficiency can nevertheless not be explained by a change of field operation protocols. Migrant birds behaviour may explain this discrepancy, as they may explore larger territories, and thus remain less time on a same site. The probability for a bird to leave a site between its detection and the settlement of a culling operation thus increases, which would explained this lower efficiency.

In order to evaluate a probable connectivity among European ruddy duck populations, a genetic study comparing genetic diversity before and after the 2021-2022 winter is under progress. If a movement of birds is indeed highlighted, a cohesive and coordinated fight at the European scale will be a necessary condition to fulfill the ruddy duck eradication objective.

4.3 Alternative methods still being deployed

An improvement, even at a small scale, in culling rates before reproduction could have a significant impact on the capacity of the population to recover. It is for this reason that considerable effort has been implemented within the LIFE framework to test different capture methods, notably in winter (Section 2.1.2).

The use of shooting stands was part of the first 2020 winter tests and enabled the culling of two females in February 2020. However, this method remains unreliable due to the difficulty to attract birds near the shooting stands. During the 2021 and 2022 winters, no birds were culled with this method. In March 2021, the ruddy ducks came near the Grand-Lieu lake shores, and were observed in coves with banks covered by willow trees. Thanks to this behaviour (observed for the first time), the shooting operations were a success¹⁹. Nevertheless, this behaviour was not observed in 2022.

On the other hand, the development of a capture method using a living decoy was retarded several times. While the cage trap design was completed at the end of 2020, authorizations to detain females ruddy duck were only obtained in June 2021²⁰. Captive ruddy ducks were collected since the 2021 summer thanks to the collaboration with Aviornis, and are thus available to be used as calling females. The avian flu virus episode in France due to the H5N8 virus since autumn 2020 has nevertheless prevented the first tests from being carried out due to the difficulty to transport birds. This method will thus be tested during the end of the 2023 winter to demonstrate its efficiency and to investigate whether it may be employed in the Netherlands, where culling by shooting is difficult due to the urbanization of sites inhabited by the ruddy duck.

¹⁹Four operations were set up and allowed to cull six of the 16 individuals detected the previous months.

²⁰Competency certificate and opening authorization.

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A Evidence of moulting in coastal areas?

The moulting season of ducks is a vulnerable period that is propitious for capturing them. If, as with other species, ruddy ducks gather together in this period of the year, it would therefore be efficient to identify the moulting sites. This aspect of ruddy duck ecology is poorly known within its natural range. The low number of sightings during this period shows that the birds are more wary at this time.

Throughout the year, ruddy ducks in France are mainly observed in areas less than 100 km from the coast (Figure 17). This could reflect the potential species' dependence on coastal habitats, notably during the moulting season. Analysis of the positions of the sites where the ruddy ducks are observed shows that the birds sighted during the moulting season²¹ are more numerous in coastal areas than during the rest of the year. This could be evidence that some of the population moults in coastal areas. Unfortunately, this result is not significant enough to conclude that the moult occurs in coastal areas, and therefore to consider carrying out specific surveys to identify a potential moulting site. A plausible hypothesis concerning the presence of ruddy ducks in this area in autumn is the utilization of the wastewater treatment lagoons of seaside resorts as a food source and refuge area during the hunting season.

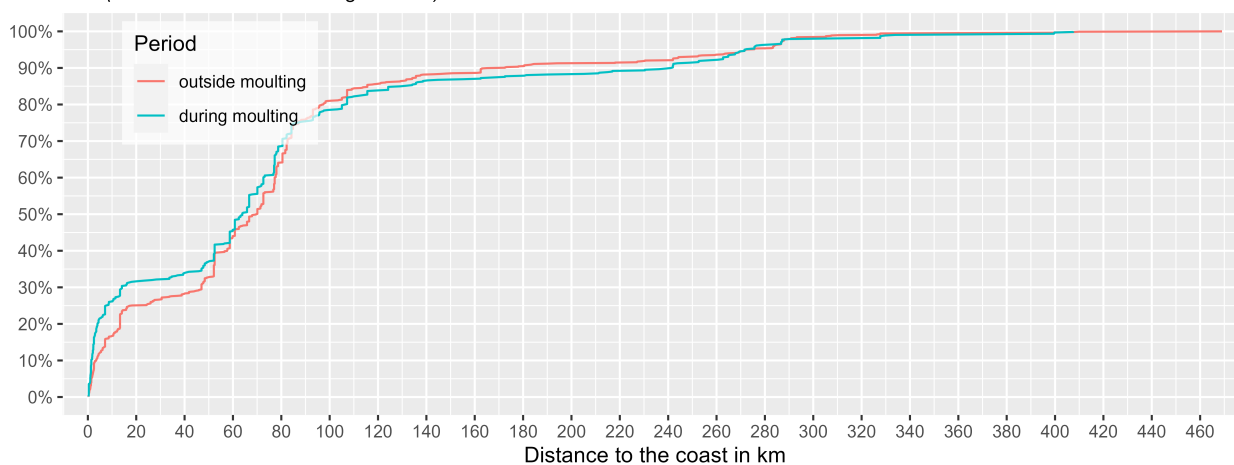
Distribution of ruddy ducks with regard to the coast during and outside the moulting season

Data correspond to proportion of observations made within a specified distance from the coast

- Aggregated data from 1994 to 2022

- 80% of the observations are within a 100km radius from the coast (100% are within a 400km radius)

- 20% of the observations are within a 5km radius from the coast during the moulting season
(12% outside the moulting season)



Source: Faune France, SNPN & OFB

Figure 17: Distribution of ruddy ducks with regard to the coast during and outside the moulting season.

²¹This period is defined in the analysis as between the 1th of August and the 1th of December, from the evidence provided by Baldassarre (2014)

B Data by department

For the detail of the historical observation sites, see the [interactive map online](#).

Table 1: Table of individuals culled and number of sites occupied by department

Department	Year	Numbers culled by category				Total	Number of sites
		Female	Male	Young	Under-temined age		
44-Loire-Atlantique	2020	9	13	7	0	29	2
	2021	4	7	0	0	11	1
	2022	4	6	12	0	22	2
	< 2020	196	312	373	100	981	35
53-Mayenne	2020	4	0	0	0	4	3
	2021	1	0	1	0	2	3
	2022	0	0	0	0	0	1
	< 2020	137	134	192	47	510	44
85-Vendée	2020	5	6	1	0	12	4
	2021	0	0	0	0	0	0
	2022	1	1	1	0	3	4
	< 2020	43	32	64	86	225	20
35-Ille-et-Vilaine	2020	0	0	0	0	0	1
	2021	0	0	0	0	0	1
	2022	0	0	0	0	0	1
	< 2020	81	43	11	66	201	19
49-Maine-et-Loire	2020	2	2	2	0	6	4
	2021	0	1	2	0	3	3
	2022	0	0	1	0	1	3
	< 2020	16	29	24	11	80	22
80-Somme	2020	0	1	0	0	1	2
	2021	0	0	1	0	1	1
	2022	0	0	0	0	0	0
	< 2020	12	18	4	13	47	16
56-Morbihan	2020	0	0	0	0	0	1
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	0
	< 2020	9	9	6	2	26	17

Department	Year	Numbers culled by category				Total	Number of sites
		Female	Male	Young	Under-temined age		
72-Sarthe	2020	0	0	0	0	0	0
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	0
	< 2020	4	4	4	12	24	12
17-Charente-Maritime	2020	2	1	0	0	3	4
	2021	0	0	0	0	0	1
	2022	0	0	5	0	5	2
	< 2020	6	3	6	4	19	13
79-Deux-Sèvres	2020	0	0	0	0	0	0
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	0
	< 2020	1	6	0	8	15	10
37-Indre-et-Loire	2020	0	0	0	0	0	0
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	0
	< 2020	3	4	0	0	7	3
41-Loir-et-Cher	2020	0	0	0	0	0	0
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	0
	< 2020	1	0	4	0	5	7
13-Bouches-du-Rhône	2020	0	0	0	0	0	0
	2021	0	0	0	0	0	1
	2022	0	0	0	0	0	1
	< 2020	1	1	0	1	3	18
59-Nord	2020	0	0	0	0	0	1
	2021	0	0	0	0	0	2
	2022	1	1	0	0	2	2
	< 2020	1	1	1	0	3	18
27-Eure	2020	1	0	0	0	1	2
	2021	0	0	0	0	0	0
	2022	0	3	0	0	3	2
	< 2020	0	1	0	0	1	7

Department	Year	Numbers culled by category				Total	Number of sites
		Female	Male	Young	Under-temined age		
61-Orne	2020	0	0	0	0	0	0
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	0
	< 2020	1	2	0	0	3	4
50-Manche	2020	0	2	0	0	2	2
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	1
	< 2020	0	1	0	1	2	12
62-Pas-de-Calais	2020	0	0	0	0	0	0
	2021	0	1	0	0	1	1
	2022	0	0	0	0	0	2
	< 2020	0	0	0	2	2	11
33-Gironde	2020	0	0	0	0	0	0
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	0
	< 2020	0	0	0	2	2	6
34-Hérault	2020	0	0	0	0	0	0
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	0
	< 2020	0	1	0	1	2	6
51-Marne	2020	0	1	0	0	1	1
	2021	0	1	0	0	1	5
	2022	0	0	0	0	0	1
	< 2020	0	0	0	1	1	10
36-Indre	2020	0	0	0	0	0	1
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	1
	< 2020	0	0	0	1	1	9
77-Seine-et-Marne	2020	0	0	0	0	0	0
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	0
	< 2020	0	1	0	0	1	6

Department	Year	Numbers culled by category				Total	Number of sites
		Female	Male	Young	Under-temined age		
89-Yonne	2020	0	0	0	0	0	0
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	0
	< 2020	0	1	0	0	1	2
19-Corrèze	2020	0	0	0	0	0	0
	2021	0	0	0	0	0	0
	2022	0	0	0	0	0	0
	< 2020	0	1	0	0	1	1