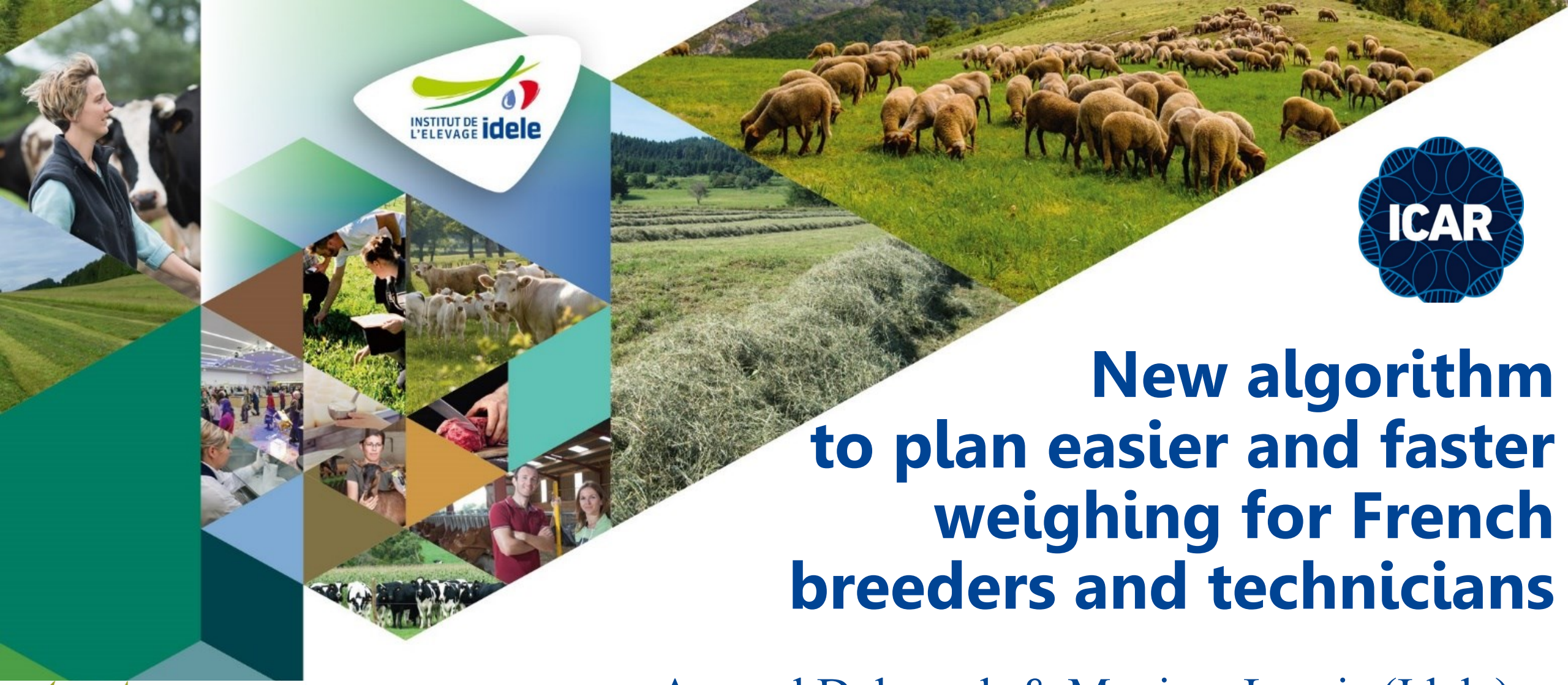


New algorithm to plan easier and faster weighing for French breeders and technicians

Arnaud Delpeuch & Maxime Legris (Idele)

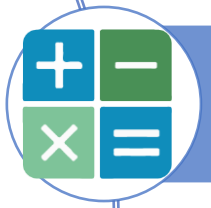
Gabriel Augier (Eliance), Lauréna Jeannot, David Delgoulet,

Marion Le Hung, Laurent Griffon (Race de France)

AGENDA

New algorithm to plan easier and faster weighing for French breeders and technicians

Project background and objectives



Specifications of the algorithm

Focus on our dedicated RShiny app

Algorithm performance, discussion and conclusion

WEIGHING IN FRENCH BEEF CATTLE RECODING

Calculation mode

Durations

Birth weight reliability

Set of weighings **carried out**

Calculating rules process

Adjusted Weights and Reliability

271kg for AW210 days

3 in reliability level (1 to 7)

AN ALGORITHM TO PLAN WEIGHING SESSIONS?

Distribution of birth

Minimum reliability desired

Breeding constraints

Best weighings date(s) **to plan**

Algorithm developed in PATApi

INPUTS – CALCULATIONS PARAMETERS

Reliability

AW to optimise

Use all reliability levels or not

Number of weighings desired

```
"ParametresDemandeCalcul": {
    "OPTIMI": ["04", "07" ],
    "PlageInterdite": [
        {
            "DADEINT": "2023-05-01",
            "DAFIINT": "2023-05-09"
        },
        {
            "DADEINT": "2023-07-01",
            "DAFIINT": "2023-07-14"
        }
    ],
    "ALLFIAB": false,
    "AGSORTF": 1000,
    "AGSORTM": 700,
    "NBPESE": 2,
    "NUMPROF": 1,
    "DTPESO": ["2023-06-15"],
    "TYPERETOUR": "C"
},
```

Periods

Prohibited date range

Average exit

Suggested weighing date

Output type

INPUTS – ANIMAL CHARACTERISTICS


```
"DonneesAnimaux": [
    {
        "COPAIP": "FR",
        "NUNATI": "xxxxxxxx68",
        "DANAIS": "2020-02-23",
        "CORABO": "38",
        "SEXBOV": "1"

    },
    {
        "COPAIP": "FR",
        "NUNATI": "xxxxxxxx42",
        "CORABO": "38",
        "DANAIS": "2019-11-26",
        "SEXBOV": "1",
        "EXCLUS": false,
        "UTILPN": true,
        "DATEPE": "2020-02-28"

    },
    {
        "COPAIP": "FR",
        "COPAIP": "FR",
        "NUNATI": "xxxxxxxx32",
        "CORABO": "38",
        "DANAIS": "2019-10-03",
        "SEXBOV": "1",
        "EXCLUS": false,
        "UTILPN": true

    },
```


Date of birth
(Actual or expected)

Date of weighings carried out

Excluded from planning ?

Birth weight usable ?

Up-to-date forecast over time

Take into account weighings carried out

Do not take into account atypical calves

Take birth weight into account if it is reliable

The Sort and Selection Indicator to find optimal set of dates

$$SSI = A * (1C + 0.9D + 0.8E) * \frac{1}{\sqrt{J}}$$

Animals AW %

Favor solutions with high reliability rather than low reliability

Maximising solutions with few weighing dates

TWO SOLUTION SEARCH MODES

Optimised and simple

- Using the **“Simulated Annealing” method** to maximise the SSI function
- Only **the best solution** and results around +- 7 days
- Give **the optimal number of weighing**
- **Fast** search

Exhaustive and detailed

- Using a **grid of combination** of dates and compute all the SSI values
- **Curves visualisation** of AW ratio and SSI over time
- Use **the interactive mode** by relaunching in series
- **Low** search

OUTPUTS OF THE ALGORITHM

Optimised and simple mode

Optimal weighing dates and Sort Selection Indicator


```
"PredictionDatesPesees": {
  "ITPRED": 0.5884,
  "DATEPREDI": ["2020-04-24", "2020-09-18"]
},
```


Adjusted Reliability stats


```
"EffectifParPAT": [
 {
   "COAGTY": "04",
   "EffectifParNiveau": [
     {
       "NIFPAT": "C1",
       "EFFANX": 0
     },
     {
       "NIFPAT": "C2",
       "EFFANX": 0
     },
     {
       "NIFPAT": "C3",
       "EFFANX": 0
     },
     {
       "NIFPAT": "C4",
       "EFFANX": 9
     },
     {
       "NIFPAT": "C5",
       "EFFANX": 48
     },
```


Same results plus or minus 7 days from optimum dates

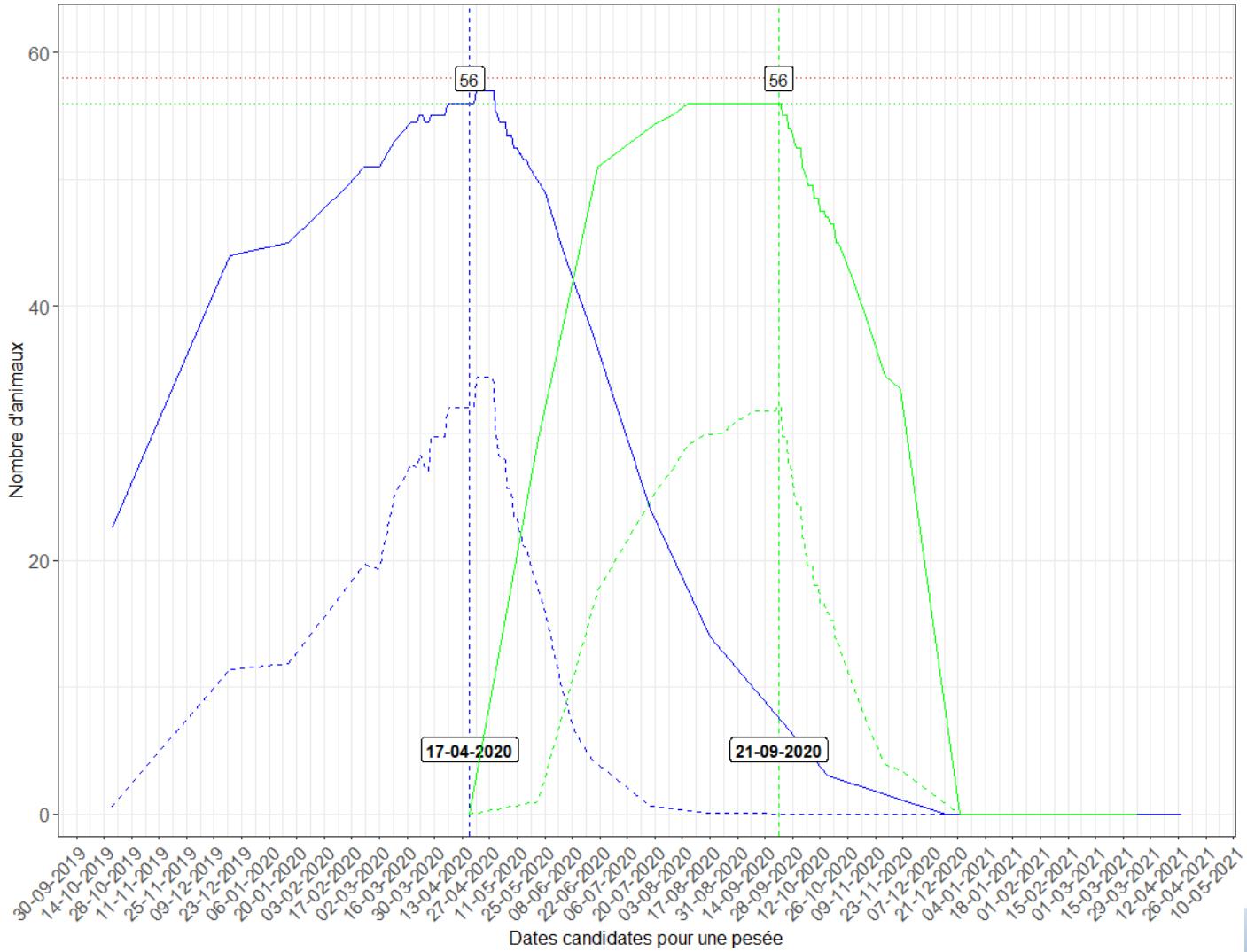

```
"ResultatsDecales7Jours": [
 {
   "DateDecalees": {
     "ITPRED": 0.5479,
     "DATEPREDI": ["2020-04-17", "2020-09-11"]
   },
   "EffectifsDecales": [
     {
       "COAGTY": "04",
       "EffectifParNiveau": [
         {
           "NIFPAT": "C1",
           "EFFANX": 0
         },
         {
           "NIFPAT": "C2",
           "EFFANX": 0
         },
         {
           "NIFPAT": "C3",
           "EFFANX": 0
         },
         {
           "NIFPAT": "C4",
           "EFFANX": 7
```

OUTPUTS OF THE ALGORITHM

Exhaustive and detailed mode


```
"PossibleParPAT": [
  {
    "NUMEROPESEE": 1,
    "PointDeLaCourbe": [
      {
        "DATECANDIDATE": "2019-10-22",
        "NBANXPAT": 22.5,
        "VALEURIT": 0.0106
      },
      {
        "DATECANDIDATE": "2019-12-21",
        "NBANXPAT": 44,
        "VALEURIT": 0.1949
      },
      {
        "DATECANDIDATE": "2020-01-20",
        "NBANXPAT": 44,
        "VALEURIT": 0.2024
      },
      {
        "DATECANDIDATE": "2020-02-19",
        "NBANXPAT": 51,
        "VALEURIT": 0.3419
      },
      {
        "DATECANDIDATE": "2020-02-27",
        "NBANXPAT": 51,
        "VALEURIT": 0.3353
```


Curves of performance over all the period



FOCUS ON SHINY WEB INTERFACE

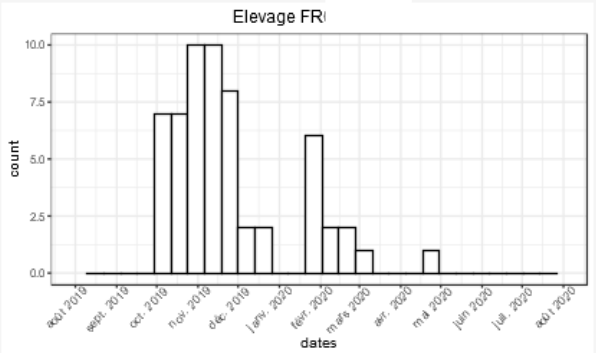
1

Paramétrages | Options de visualisation | Contraintes

Choix d'élevage

FR

Précédent | Aléatoire | Suivant



Il y a 58 animaux dans l'élevage FR01001072. La date moyenne est 26-11-2019 et la durée de la plage est de 202 jours.

Nombre de dates

○ 1 date ◉ 2 dates ○ 3 dates ○ 4 dates

Méthode de calcul

○ exacte ◉ approchée

Pas de temps (en jrs)

8

Maximisation de

○ PAT120 ○ PAT210 ◉ PAT120 et PAT210

Classe PAT120

☑ C1 ☑ C2 ☑ C3 ☑ C4 ☑ C5 ☑ C6 ☑ C7 ☐ C8 ☐ C9

Classe PAT210

☑ C1 ☑ C2 ☑ C3 ☑ C4 ☑ C5 ☑ C6 ☐ C7

c =	d =	e =	
1	0,9	0,8	☑ Sélectionner sur IT

3

Plot par dates | Pesées

Choix de la date d1 :

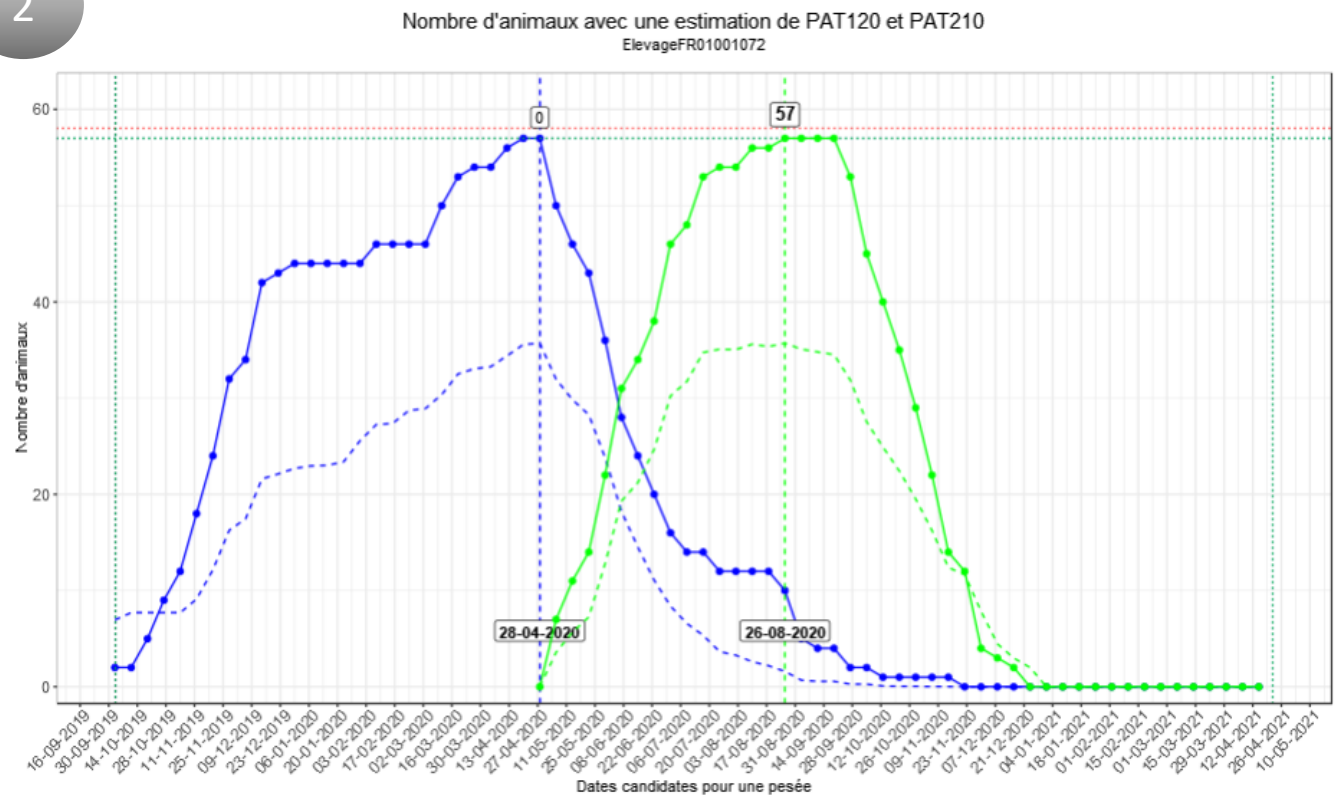
03-10-2019 — 28-04-2020 — 15-04-2021

Choix de la date d2 :

28-04-2020 — 26-08-2020 — 15-04-2021

Le graphique ci-dessous montre les possibilités d'estimation des PAT120 et PAT210 en fonction des critères d'exigence définis par l'utilisateur. L'axe des abcisses représente les dates de pesées potentielles et l'axe des ordonnées représente un nombre d'animaux avec des bonnes estimations de PAT. La ligne horizontale en pointillés rouges représente le nombre d'animaux dans la campagne de naissance (ici 58). La courbe bleue représente le nombre maximal de PAT qu'on peut obtenir avec une 1ère date. Pour représenter les possibilités pour la 2ème date, il est nécessaire de fixer une date d1 (cf réglette ci-contre) qui sera représentée sur le graphique par la ligne verticale en pointillés bleus. La courbe verte représente le nombre de PAT qu'on peut obtenir avec les 2 dates de pesées.

2



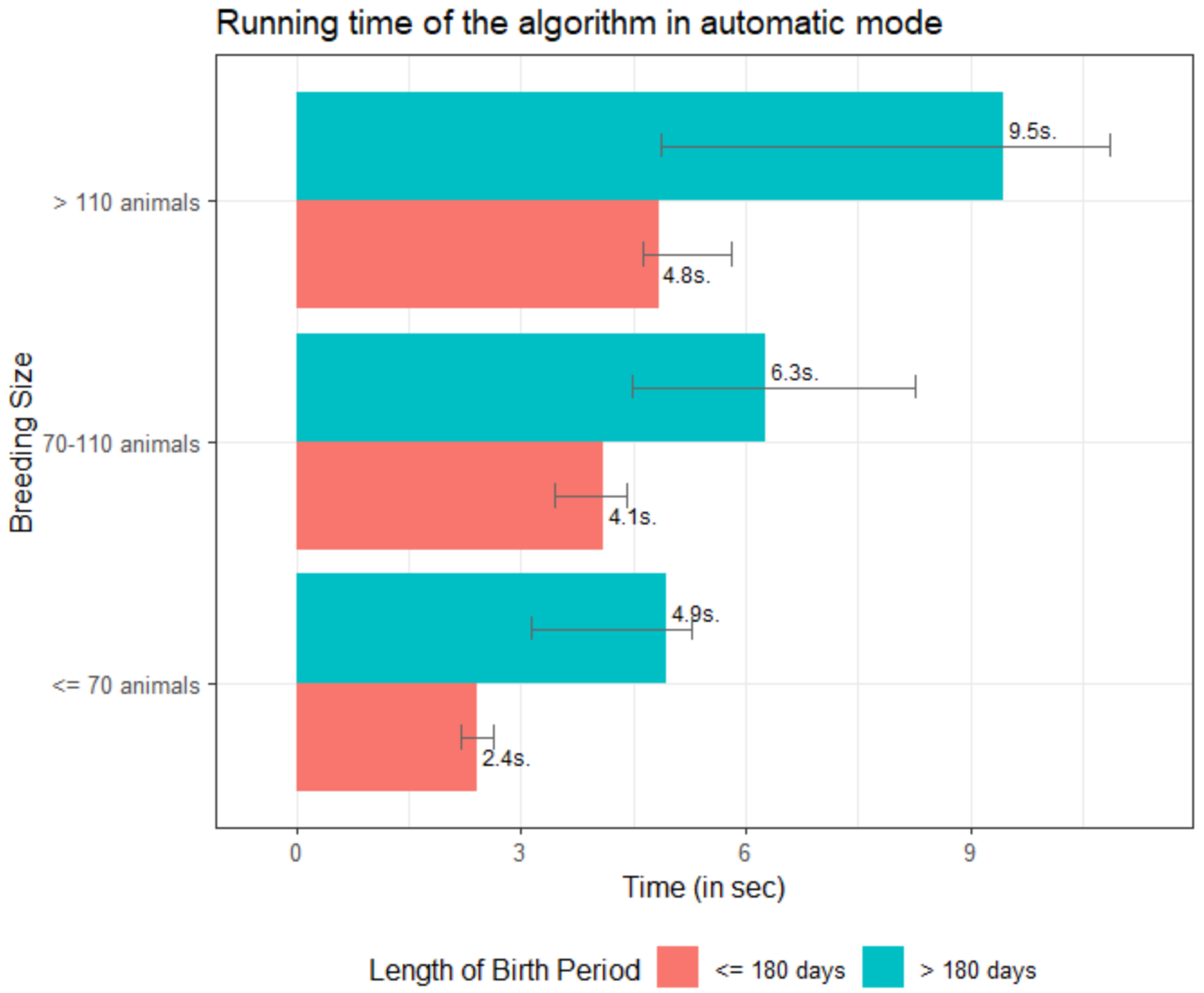
classe	PAT120	PAT210
C1	0	2
C2	0	0
C3	0	6
C4	9	24
C5	49	1
C6	0	24
C7	0	0
C8	0	NA
C9	0	NA

Q	Definition	Valeur
A	%age_PAT120	1.00
B	%age_PAT210	0.98
C	%age_fiab.+++	0.07
D	%age_fiab.++	0.72
E	%age_fiab.+	0.21
IT	Indice_de_tri	0.62

Satisfying performance

- 45 farms tested 20 times
- 2 or 3 weighing dates in most cases
- In optimised mode
  - **2.4s(*) for standard farms and 6month birth period**
  - **9.5s(*) for large farms and spread-out birth period**
- **Herd features have a strong impact on performance**

(*)median calculation time

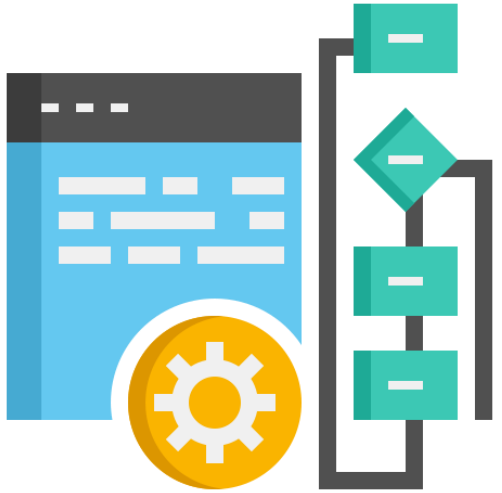


DISCUSSION

Set of functions inside a R package which allows flexibility of future evolution

- Include new AW rules
- Develop other Sort and Selection Indicator
- …

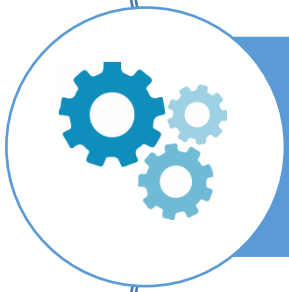
Calculation time could be improved evolution



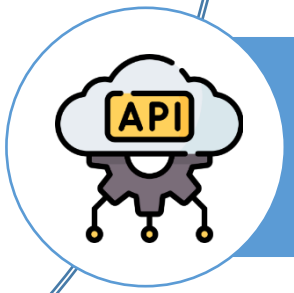
- parallel calculation
- …

CONCLUSION

Algorithm meets user expectations



Satisfactory performance, but could be improved



Future Integration into FGE Web-services tools

Thank you !

Project funders

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MINISTÈRE DE L'AGRICULTURE ET DE LA SOUVERAINETÉ ALIMENTAIRE
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LANAUD - FRANCE

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