

# MONITORING OF MORTALITY IN BELGIAN HONEYBEE COLONIES 2020-2021

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FASFC GT Varroa, 22/12/2021

# Object

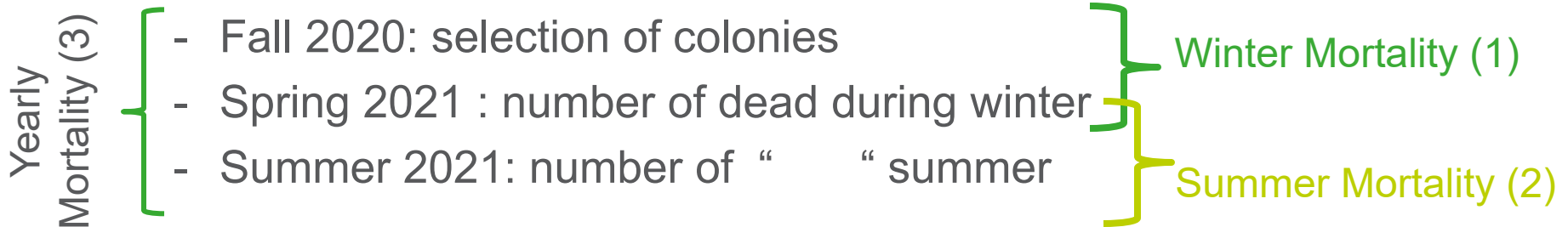
- Continuation of the program of surveillance of honeybee colonies health launched by FASFC in 2016.
- Monitoring of honeybee colonies mortality in Belgium 2020-2021

# Sampling methodology

- Population frame:
  - 9056 registered beekeepers in Belgium:
    - ~5400 in Flanders
    - ~3500 in Wallonia
    - ~ 200 in Brussels
- Sampling :
  - 2 stage sampling :
    - ~ 25 apiaries per LCU
    - 1 to 6 colonies per apiary (only strong colonies)

# Data collection

- 3 visits :



- Data collected:

- Number of colonies alive, dead, sold, potential reason of death, feeding strategy, treatment(s).
- Merged or weak colonies considered as dead.

# Methodology : Statistical analysis

- Winter mortality

- Colony mortality ( $Pi_{v2}$ ):

$$Pi_{v2} = \frac{dead_{v2}}{mi_{v1}}$$

- Weighed Colony Sample Mortality (WCSM) :

$$WCSM = \frac{\sum(Mi_{v1} * Pi_{v2})}{\sum Mi_{v1}}$$

- Seasonal mortality

- $Pi_{v3} = \frac{dead_{v3}}{mi_{v2}}$

- Year mortality

- $Pi_{vy} = \frac{dead_{v2} + dead_{v3}}{mi_{v1}}$

# Data 'cleaning'

Raw sample : 846 colonies selected in 199 apiaries.

## For winter :

- 7 suppression for lack of data
  - 5 in Liège
  - 1 in BNA
  - 1 in OVB
- 1 in OVB for non-valid data
  - > final dataset of 814 colonies in 191 apiaries.

## For summer:

- 17 apiaries with 100% winter mortality
  - > dataset of 629 colonies in 174 apiaries

## For year:

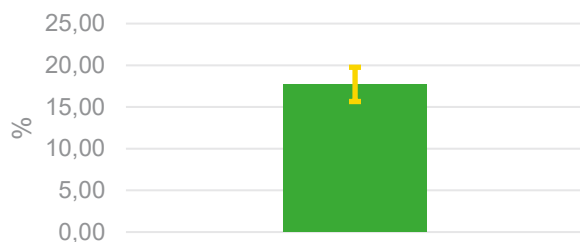
-> 174 apiaries and 764 colonies

# Sample distribution, by geographical entity

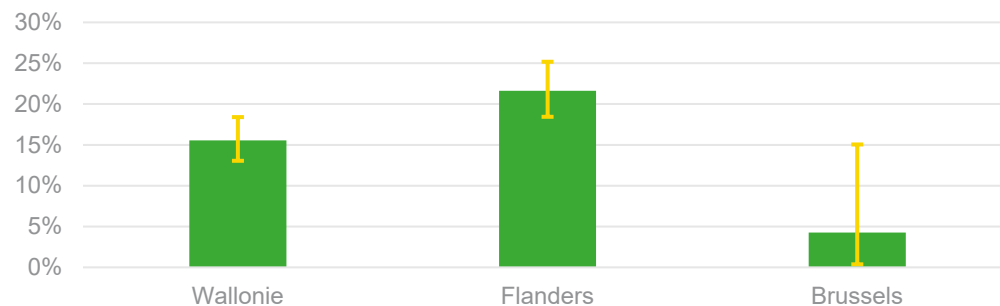
Geographical Entity	Beekeepers in population		Selected apiaries		Total colonies within selected apiaries	Selected colonies
	N	%	n	%	Mi	mi
<b>Belgium</b>	9.056	100%	191	100	1.328	814
<b>Flanders</b>	5.368	59%	93	49%	573	367
<b>Wallonia</b>	3.481	38%	90	47%	708	414
<b>Brussels</b>	207	2%	8	4%	47	33
<b>Antwerp</b>	1.460	16%	24	13%	136	95
<b>East-Flanders</b>	1.175	13%	22	12%	136	85
<b>Limburg</b>	984	11%	13	7%	199	63
<b>FI Brabant</b>	960	11%	10	5%	91	52
<b>West Flanders</b>	789	9%	24	13%	110	72
<b>Hainaut</b>	873	10%	24	13%	169	114
<b>Liege</b>	743	8%	19	10%	150	69
<b>Luxembourg</b>	627	7%	21	11%	159	100
<b>Namur</b>	796	9%	14	7%	135	74
<b>Wal Brabant</b>	442	5%	12	6%	95	57

# Winter mortality 2020-2021

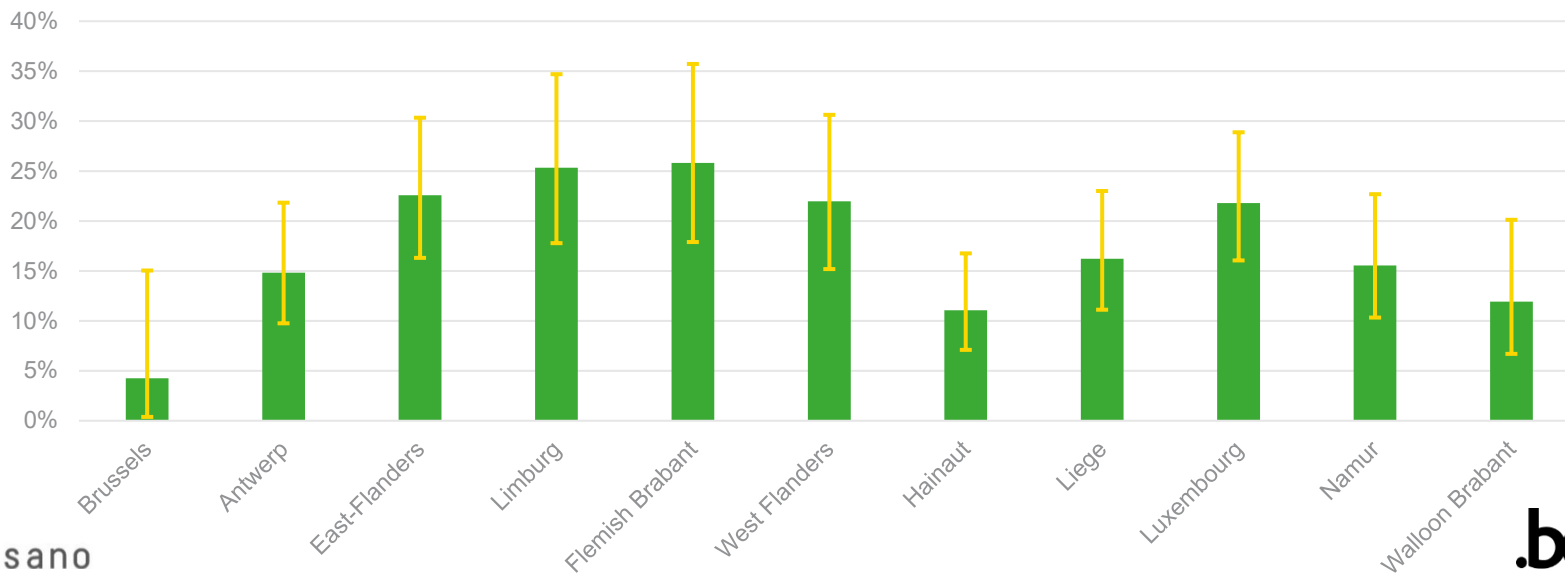
## Belgium Winter mortality



## Regions Winter mortality



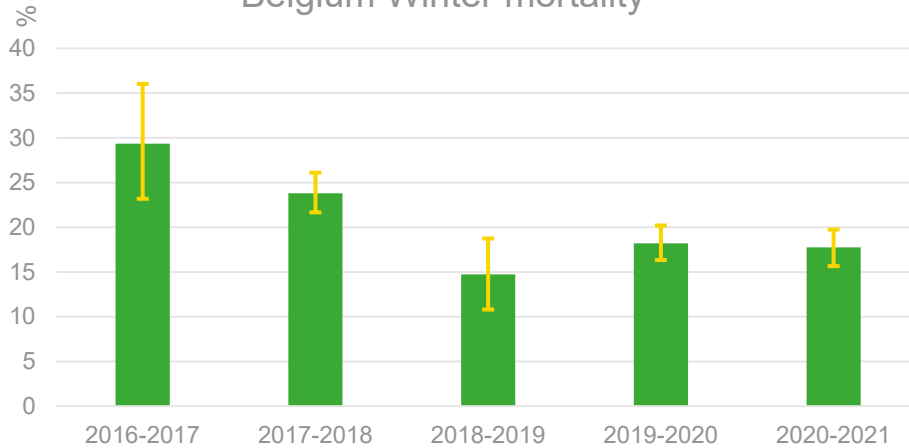
## Provinces Winter Mortality



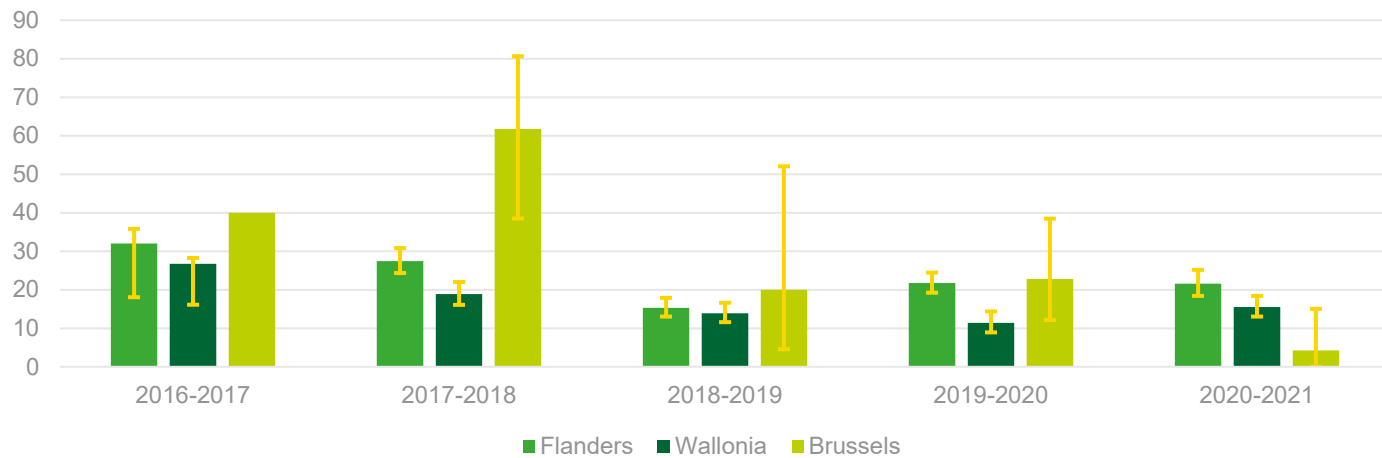


# Winter mortality evolution

Belgium Winter mortality



Region winter mortality

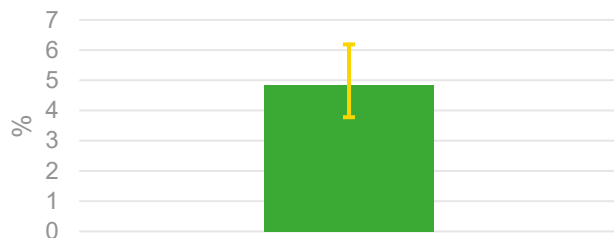


# Winter mortality details

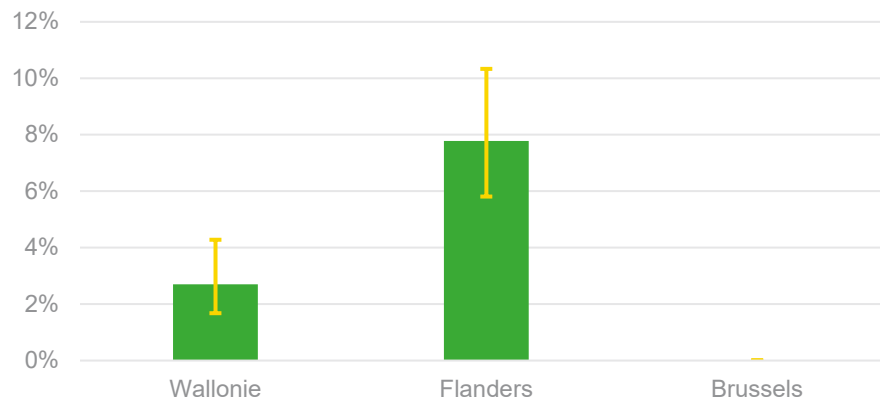
Geographical entity	Sampled apiaries 2021	Sampled colonies 2021	Overwintering weighted colony mortality from Fall to Spring											
			Estimated mortality											
			2016-2017		2017-2018		2018-2019		2019-2020			2020-2021		
%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	
<b>Belgium</b>	191	814	<b>29.34</b>	23.19-36.03	<b>23.81</b>	21.66-26.10	<b>14.73</b>	10.81-18.74	<b>18.2</b>	16.34	20.2	<b>17.76</b>	15.66	19.76
<b>Brussels</b>	8	33	<b>40</b>	NA	<b>61.76</b>	38.53-80.66	<b>20</b>	4.59-52.06	<b>22.81</b>	12.13	38.5	<b>4.26</b>	0.00	15.04
<b>Flanders</b>	93	367	<b>32.02</b>	18.09-35.84	<b>27.47</b>	24.35-30.83	<b>15.34</b>	13.08-17.92	<b>21.76</b>	19.24	24.5	<b>21.62</b>	18.44	25.18
<b>Antwerp</b>	24	95	<b>28.61</b>	9.49-40.14	<b>15.91</b>	11.21-22.07	<b>13.25</b>	9.19-18.7	<b>29.36#</b>	24.79	34.4	<b>14.83</b>	9.75	21.84
<b>East-Flanders</b>	22	85	<b>53.09</b>	23.96-66.27	<b>13.66</b>	8.91-20.29	<b>25.09</b>	17.26-34.94	<b>14.04</b>	9.49	20.2	<b>22.57</b>	16.32	30.34
<b>Limburg</b>	13	63	<b>18.11</b>	0.68-31.32	<b>8.21</b>	3.28-17.79	<b>8.52</b>	5.82-12.26	<b>7.55</b>	4.55	12.2	<b>25.33</b>	17.78	34.71
<b>Flem Brabant</b>	10	52	<b>27.43</b>	11.52-31.97	<b>57.45</b>	50.8-63.84	<b>20.36</b>	14.65-27.54	<b>46.36*</b>	33.85	59.4	<b>25.82</b>	17.89	35.72
<b>West Flanders</b>	24	72	<b>28.77</b>	12.62-35.35	<b>17.57</b>	11.79-25.32	<b>22.61</b>	15.87-31.12	<b>22.44**</b>	17.05	28.9	<b>21.97</b>	15.20	30.64
<b>Wallonie</b>	90	414	<b>26.73</b>	16.12-28.26	<b>18.88</b>	16.09-22.03	<b>13.93</b>	11.59-16.65	<b>11.41</b>	8.95	14.4	<b>15.54</b>	13.05	18.40
<b>Hainaut</b>	24	114	<b>20.69</b>	7.43-28.63	<b>24.13</b>	17.64-32.06	<b>23.74</b>	18.43-30	<b>36.06***</b>	21.88	53.1	<b>11.07</b>	7.10	16.76
<b>Liege</b>	19	69	<b>18.88</b>	3.04-25.56	<b>7.05</b>	4.05-11.84	<b>10.74</b>	7.34-15.41	<b>6.94</b>	4.19	11.2	<b>16.22</b>	11.12	23.01
<b>Luxembourg</b>	21	100	<b>33.98</b>	11.23-42.89	<b>27.33</b>	20.67-35.18	<b>11.19</b>	6.36-18.75	<b>4.81</b>	1.62	11.7	<b>21.80</b>	16.06	28.88
<b>Namur</b>	14	74	<b>27.46</b>	9.92-39.21	<b>22.04</b>	15.6-30.16	<b>12.5</b>	7.47-20.01	<b>8.75</b>	4.36	16.3	<b>15.56</b>	10.33	22.68
<b>Wal Brabant</b>	12	57	<b>33.9</b>	14.39-41.75	<b>17.05</b>	10.5-26.35	<b>1.49</b>	0-8.75	<b>23.61</b>	15.74	33.79	<b>11.93</b>	6.69	20.13

# Summer mortality 2021

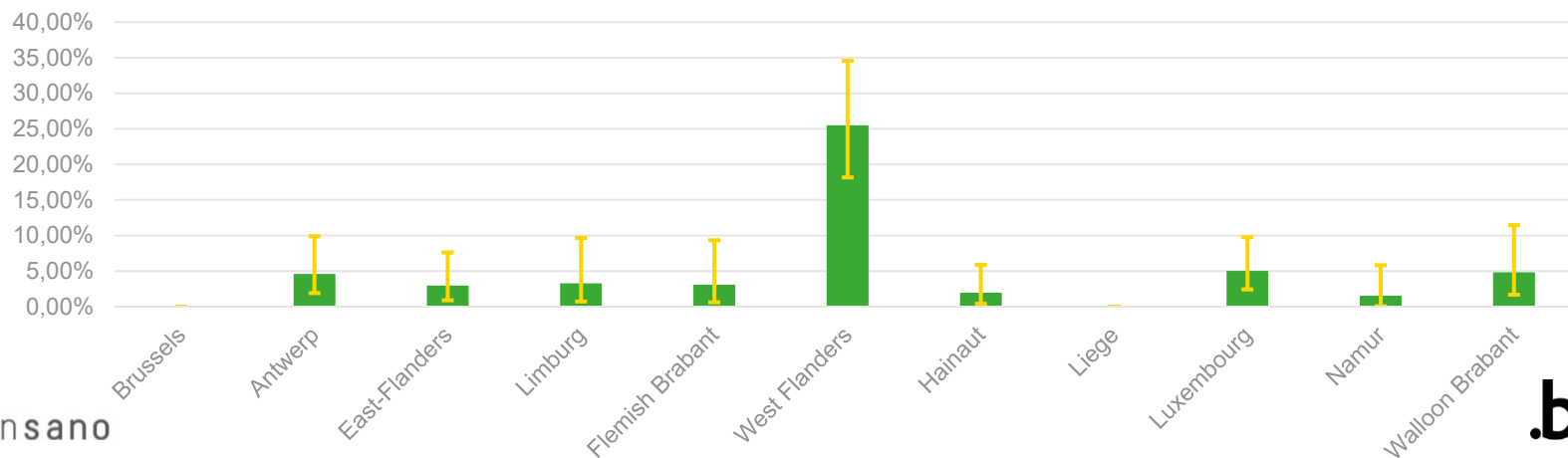
## Belgium summer mortality



## Regions summer mortality

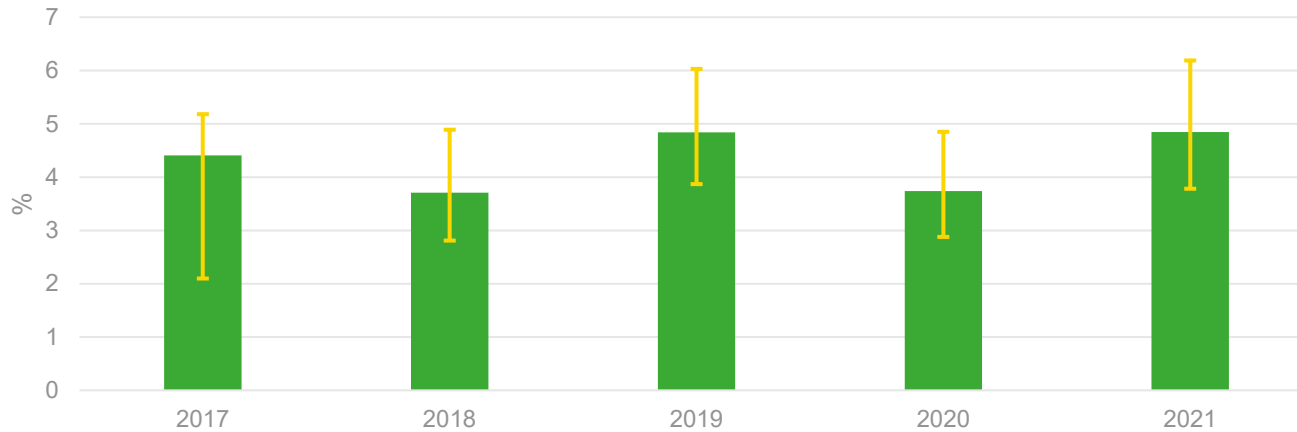


## Provinces summer mortality

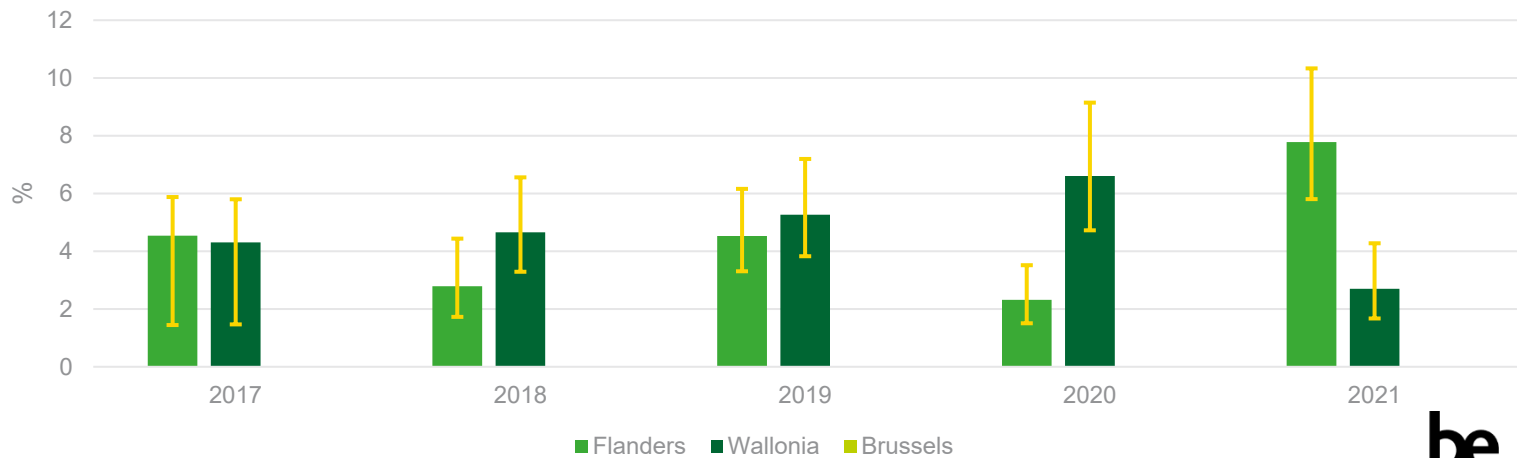


# Summer mortality evolution

## Belgium summer mortality



## Region summer mortality

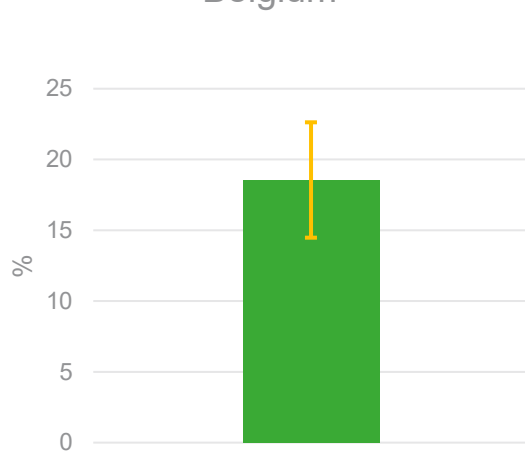


# Summer mortality details

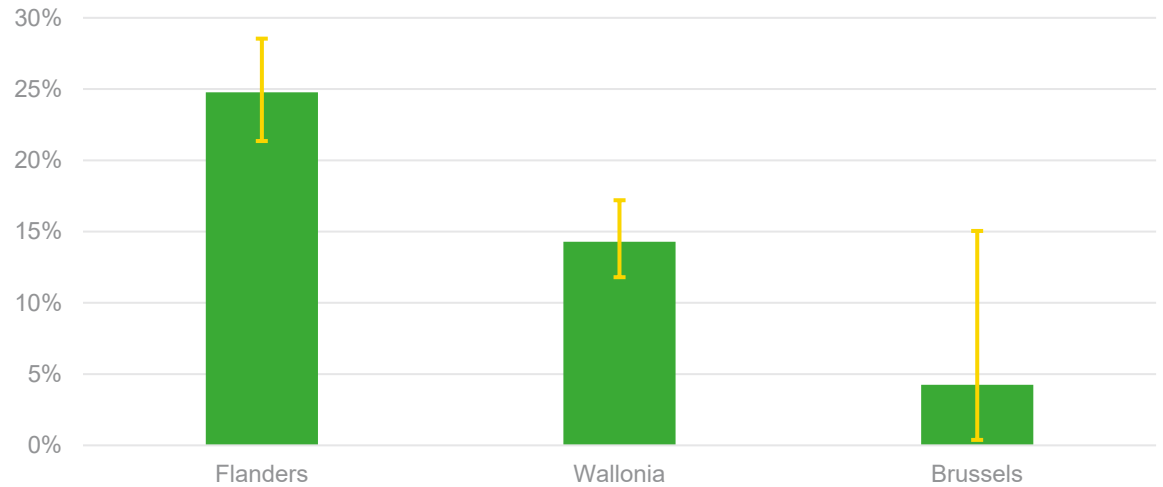
Seasonal weighted colony mortality from Spring to Summer														
Geographical entity	Sampled apiaries 2021	Sampled colonies 2021	Estimated mortality											
			2017		2018		2019		2020			2021		
			%	95% CI	%	95% CI	%	95% CI	%	95% CI		%	95% CI	
<b>Belgium</b>	<b>174</b>	629	4.41	2.10 - 5.18	3.71	2.81 - 4.89	4.84	3.87 - 6.03	3.74	2.88	4.85	<b>4.85</b>	3.78	6.19
<b>Brussels</b>	8	31	0	NA	0	NA	0	NA	0	NA	NA	<b>0.00</b>	NA	NA
<b>Flanders</b>	85	278	4.54	1.45 - 5.88	2.79	1.73 - 4.44	4.53	3.31 - 6.16	2.32	1.51	3.52	<b>7.78</b>	5.81	10.33
<b>Antwerp</b>	21	76	2.71	0 - 5.95	0	NA	0	NA	2.93	1.53	5.38	<b>4.62</b>	1.92	9.92
<b>East-Flanders</b>	21	64	2.59	0 - 6.43	3.47	1.28 - 8.09	18.92	11.91 - 28.62	3.48	1.39	7.71	<b>2.96</b>	0.00	7.63
<b>Limburg</b>	11	45	7.03	0 - 12.60	1.54	0 - 9.00	2.5	1.16 - 5.05	1	0.04	3.83	<b>3.30</b>	0.00	9.65
<b>Fl Brabant</b>	10	39	7.24	0.53-12.05	0.85	0 - 5.16	5.91	2.98 - 11.05	0	NA	NA	<b>3.08</b>	0.60	9.35
<b>West Flanders</b>	22	54	3.88	0 - 5.44	8.4	4.52 - 14.80	5.31	2.22 - 11.34	2.09	0.57	5.67	<b>25.51</b>	18.16	34.57
<b>Wallonie</b>	81	320	4.31	1.47 - 5.80	4.66	3.29 - 6.56	5.27	3.83 - 7.20	6.61	4.73	9.15	<b>2.70</b>	1.68	4.28
<b>Hainaut</b>	21	91	9.69	1.97 - 15.06	4.73	2.03 - 9.95	6.1	3.33 - 10.69	3.57	0	19.2	<b>1.96</b>	0.00	5.87
<b>Liege</b>	14	47	1.49	0 - 2.99	6.12	3.35 - 10.72	6.13	3.63 - 10.04	3.57	1.69	7.04	<b>0.00</b>	NA	NA
<b>Luxembourg</b>	21	78	6.54	0.38-10.39	0.7	0 - 4.25	6.51	2.95 - 13.11	11.43	6.11	20.1	<b>5.03</b>	2.42	9.77
<b>Namur</b>	13	57	0.83	0 - 2.20	4.65	1.89 - 10.13	2.5	0.47 - 7.68	6.25	2.63	13.2	<b>1.55</b>	0.00	5.83
<b>Wal Brabant</b>	12	47	3.05	0 - 7.17	8.14	3.72 - 16.17	2.74	0.08 - 10.52	11.6	5.94	21	<b>4.82</b>	1.69	11.47

# Year mortality 2020-2021

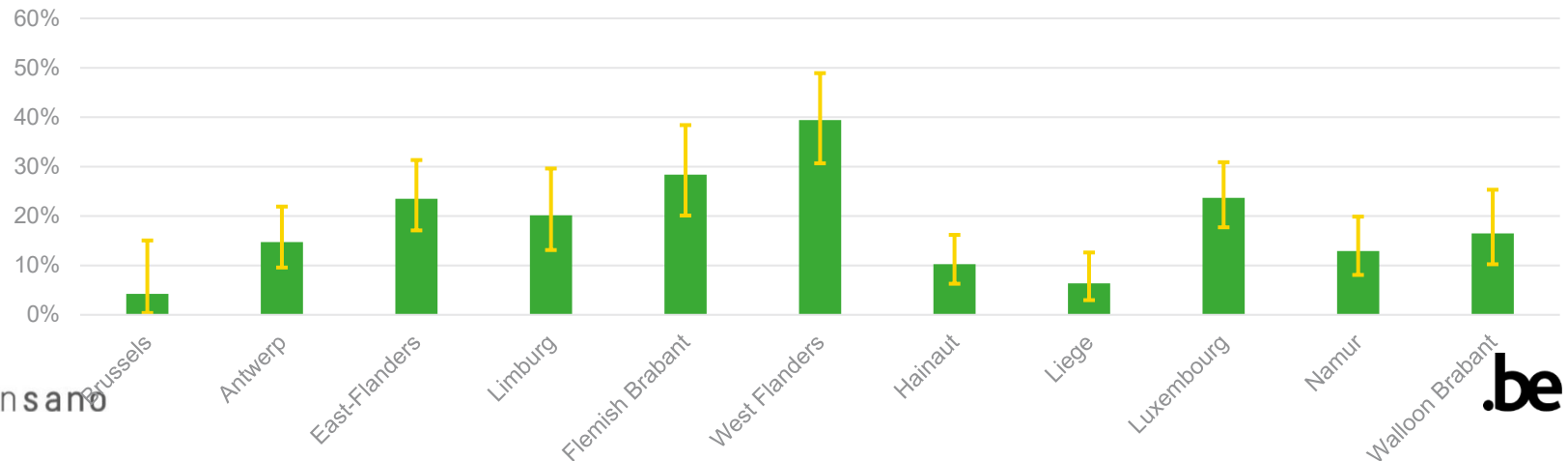
Belgium



Region year mortality

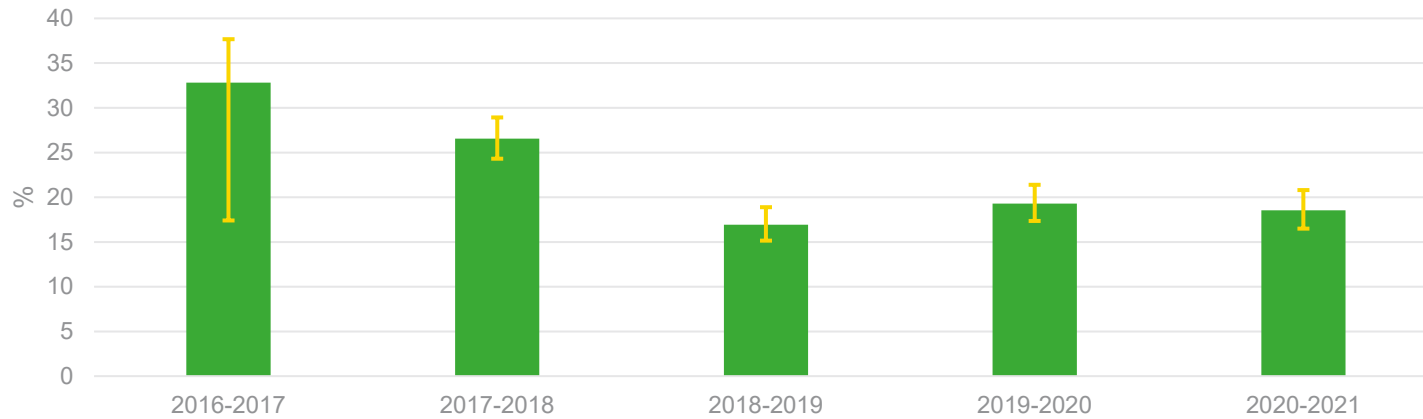


Provinces year mortality

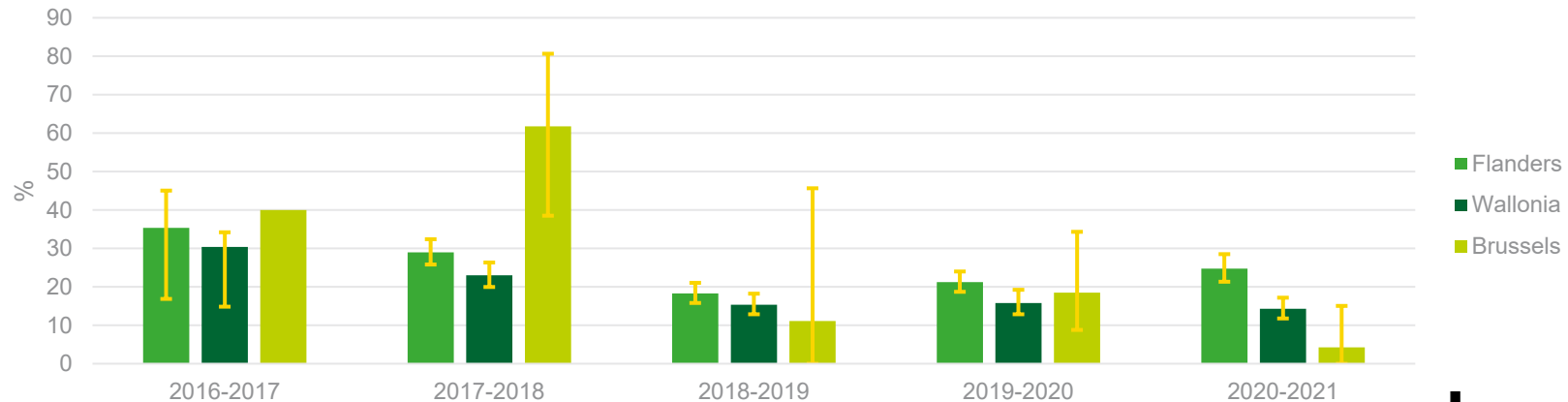


# Year mortality evolution

## Belgium year mortality



## Region year mortality



# Year mortality details

## Yearly weighted colony mortality from Fall to Summer

Geographical entity	Sampled apiaries 2021	Sampled colonies 2021	Estimated mortality											
			2016-2017		2017-2018		2018-2019		2019-2020			2020-2021		
			%	95% CI	%	95% CI	%	95% CI	%	95% CI		%	95% IC	
<b>Belgium</b>	<b>174</b>	764	32.82	17.40 - 27.68	26.56	24.32-28.92	16.94	15.15-18.9	19.29	17.35	21.4	<b>18.55</b>	16.49	20.80
<b>Brussels</b>	8	33	40	NA	61.76	38.53-80.66	11.11	0 - 45.67	18.52	8.79	34.32	<b>4.26</b>	0.38	15.04
<b>Flanders</b>	85	351	35.36	16.87 - 35.04	29	25.81-32.40	18.31	15.83 - 21.07	21.25	18.72	24.01	<b>24.77</b>	21.35	28.54
<b>Antwerp</b>	21	89	30.72	9.31 - 38.75	15.91	11.21-22.07	13.25	9.19 - 18.7	31.96	27.21	37.1	<b>14.74</b>	9.58	21.93
<b>East-Flanders</b>	21	84	54.82	19.77 - 67.66	16.67	11.40-23.66	29.71	21.29 - 40.16	15.64	10.81	22.05	<b>23.48</b>	17.09	31.34
<b>Limburg</b>	11	56	22.78	6.97 - 23.97	9.74	4.32 - 19.66	11.51	8.26 - 15.8	8.06	4.94	12.76	<b>20.15</b>	13.11	29.60
<b>Fl Brabant</b>	10	52	32.38	11.34 - 40.75	57.91	51.26-64.29	27.58	20.37 - 36.16	32.95	20.87	47.77	<b>28.39</b>	20.11	38.42
<b>West Flanders</b>	22	70	32.51	13.91 - 41.88	21.42	15.05-29.53	25.62	18.64 - 34.1	17.76	12.77	24.14	<b>39.44</b>	30.69	48.92
<b>Wallonie</b>	81	380	30.38	14.85 - 24.21	23.02	19.99-26.36	15.36	12.86 - 18.25	15.8	12.87	19.25	<b>14.29</b>	11.80	17.20
<b>Hainaut</b>	21	101	29.34	15.36 - 37.59	28.11	21.17-36.27	17.22	12.37 - 23.43	46.07	29.22	63.87	<b>10.26</b>	6.29	16.18
<b>Liege</b>	14	54	20.24	3.78 - 27.50	13.06	8.87 -18.83	10.74	7.34 - 15.41	10.08	6.7	14.82	<b>6.38</b>	2.97	12.60
<b>Luxembourg</b>	21	100	38.96	10.34 - 47.20	28.03	21.30-35.91	17.17	11.08 - 25.55	15.5	9.22	24.74	<b>23.69</b>	17.72	30.90
<b>Namur</b>	13	68	28.25	8.39 - 39.19	25.94	19.00-34.33	14.58	9.12 - 22.39	13.75	8.11	22.17	<b>12.92</b>	8.09	19.89
<b>Wal Brabant</b>	12	57	36.23	12.05 - 45.22	23.48	15.79-33.40	4.23	0.88 - 12.54	24.22	15.86	35.1	<b>16.49</b>	10.25	25.33



**Thank you for your  
attention.**