# Working paper

## Cod (*Gadus morhua*) in the Celtic Sea otolith exchange 2016

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## 1. SUMMARY

In this working document, the results of an otolith exchange on Cod (*Gadus morhua*) in the Celtic Sea are presented. Each year, stock assessment of cod in the Celtic Sea requires data to be compiled and compared. For example the age distribution from this year's assessment is compared to historical data. In 2016, there has been a small number of one year olds. Consequently, the three main countries (France, Ireland and UK England) which contribute to the cod landings in Celtic Sea organised a small otolith exchange to verify the precision of age data between four readers. Mean precision of age estimate for individual fish had a coefficient of variation (CV) of 0.2% and percent agreement to modal age of 99.5%. There was only one image where two readers identified three growth rings and the other identified four growth rings.

## 2. BACKGROUND INFORMATIONS

This small exchange was organized following the data preparation to stock assessment group in 2016. This is not a recommendation from the WGBIOP 2015 (ICES, 2015).

The last workshop on cod otoliths was organized in 2008 but this focused on the North Sea stock (ICES, 2008).

## 3. PARTICIPANTS

Four readers from five institutes participated in this exchange (Tab. 1).

Table 1: List of the readers.

| Readers | Institute | Country |
|---|---|---|
| Fiona Woods | Marine Institute | Ireland |
| Susan Beattie | Marine Institute | Ireland |
| Dave Brown | CEFAS | UK England |
| Jean Louis Dufour | IFREMER | France |

## 4. SAMPLING COLLECTION

A total of 99 fish were sampled in 2015 by Ifremer from EVHOE survey and from fish markets (Fig. 1):

- ❖ 24 fish during Quarter 1
- ❖ 25 fish during Quarter 2
- ❖ 25 fish during Quarter 3
- ❖ 25 fish during Quarter 4

The length range of the fish was between 37 and 96 cm, with mean 60 cm (Fig. 1).
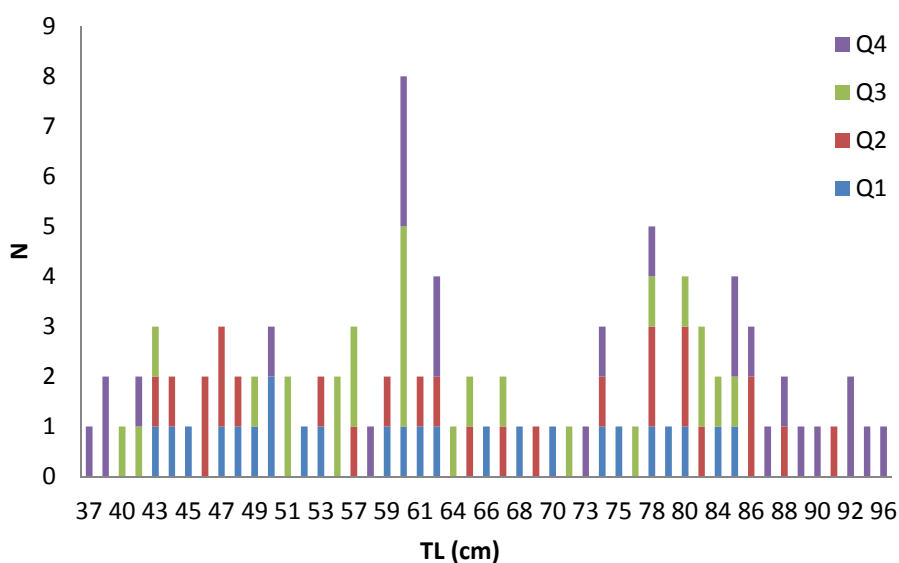


Figure 1: Histograms of the cod samples.

## 5. RESULTS

One exercise was realized on the same set of otoliths (n=99) to compare the readings with blind readings for each reader. The spreadsheet (Eltink, 2000) was completed according to the instructions contained in Guidelines and Tools for Age Reading Comparisons by Eltink *et al.* (2000). Modal ages were calculated for each otolith read, with percentage agreement, mean age and precision coefficient of variation as a definition (for each otolith):

- ➢ Percentage agreement = 100.(no. of readers agreeing with modal age/total no. of readers).

- ➢ Coefficient of variation (CV) = 100.(standard deviation of age readings/mean of age readings).

The modal age was from one to five years old. Mean precision of age estimate for individual fish were coefficient of variation (CV) of 0.2% and percent agreement to modal age of 99.5%. There was only one image where two readers identified three growth rings and the other identified four

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growth rings. These results showed that the precision of age estimation from the Celtic Sea was very high. Consequently, the ageing data were usable for stock assessment of Celtic Sea cod.

The minimal requirement for age readings consistency is the absence of bias among readers and through time. The hypothesis of an absence of bias between two readers or between a reader and the modal age estimated can be tested non-parametrically with a one-sample Wilcoxon signed rank test (Tab. 2).
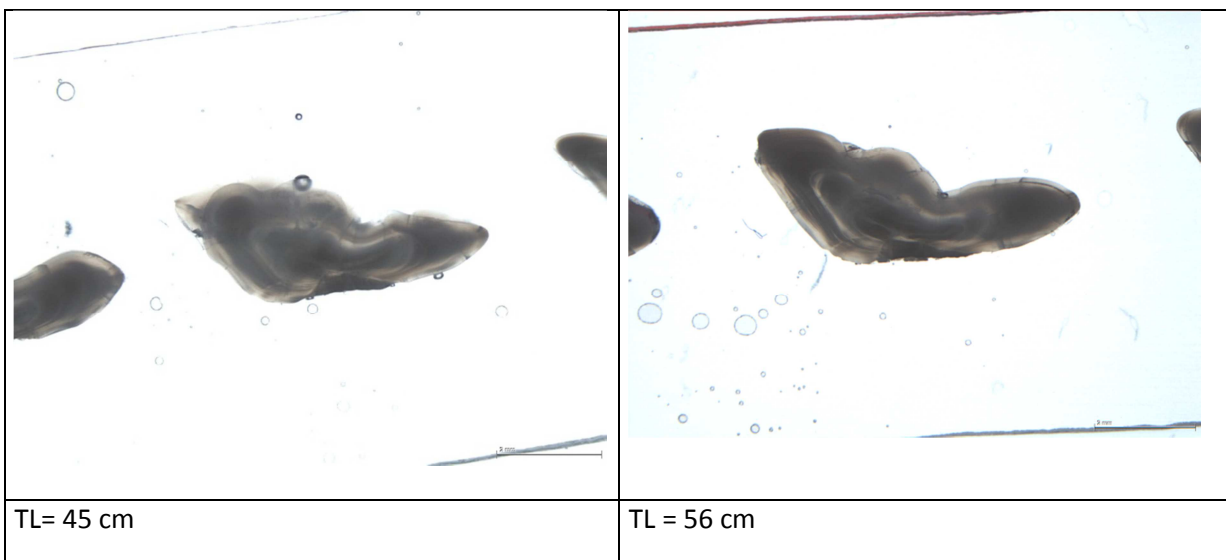
Table 2 : Inter-reader bias test and reader against modal age bias test (-: no sign of bias  (p>0.05); *: possibility of bias (0.01<p<0.05); **: certainty of bias (p<0.01)) .

|  | Fiona | Susan | Jean Louis | Dave |
|---|---|---|---|---|
|  | Ireland | Ireland | France | UK England |
| **Ireland** |  | – | – | – |
| **Ireland** | – |  | – | – |
| **France** | – | – |  | – |
| **UK England** | – | – | – |  |

| | | | | |
|---|---|---|---|---|
| **modal age** | – | – | – | – |

## 6. EXAMPLES

## Quarter 1 : Otoliths from fish market (Lorient)

### Age group 2



| TL= 45 cm | TL = 56 cm |
|---|---|

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| TL = 41 cm | TL = 46 cm |

## Age group 3



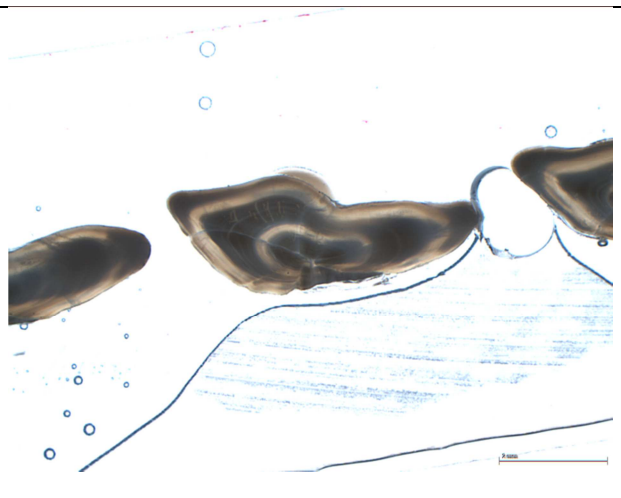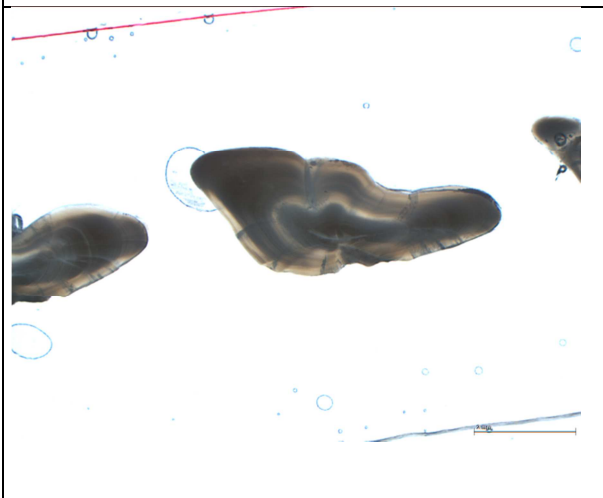| TL= 78 cm | TL = 84 cm |

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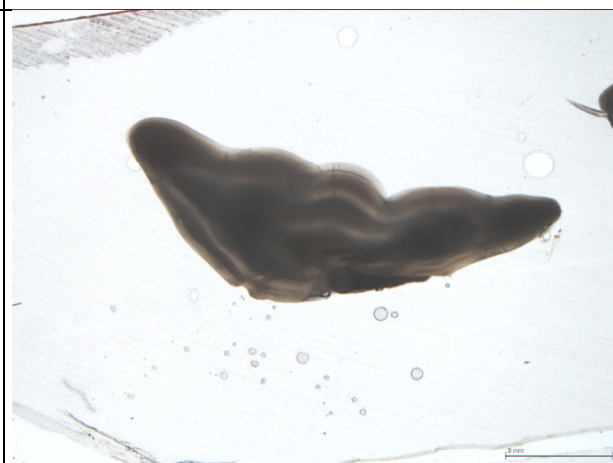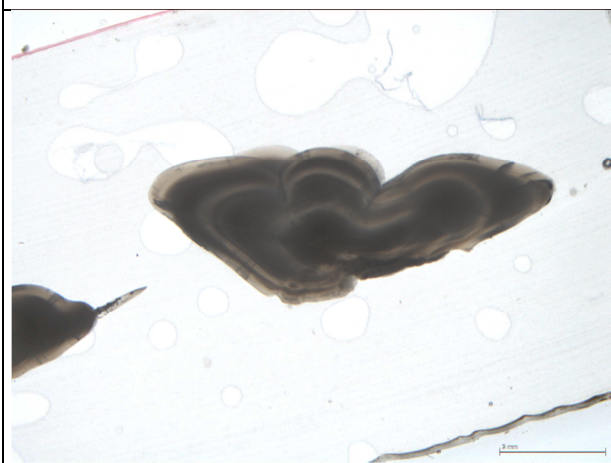
| TL = 63 cm | TL = 70 cm |
| --- | --- |

## Quarter 2 : Otoliths from fish market (Lorient)
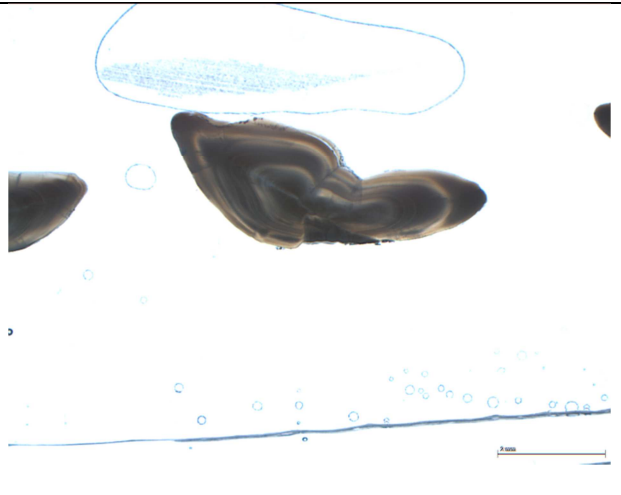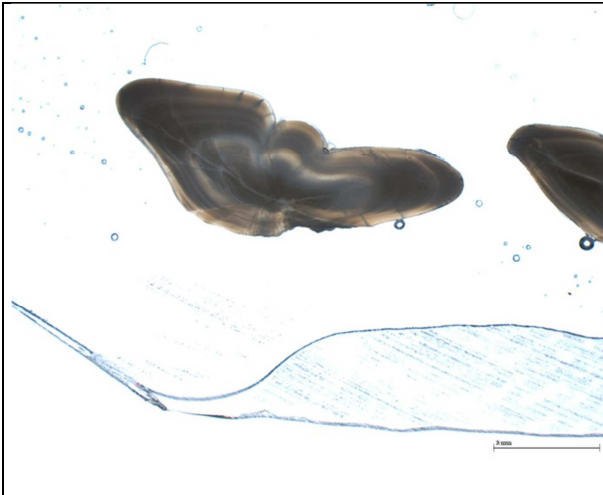
## Age group 2

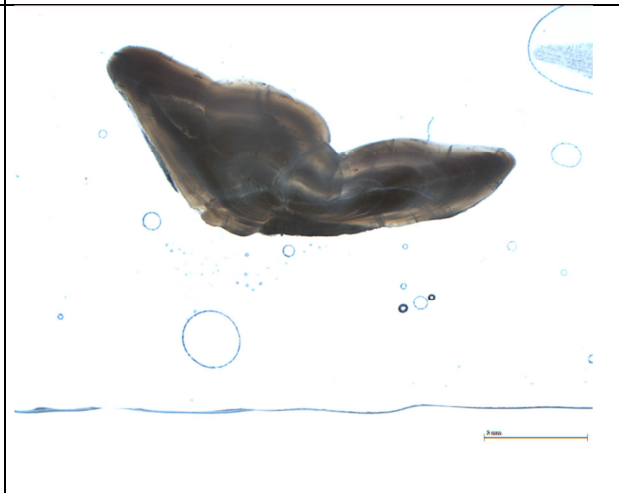| | |
| --- | --- |
| TL=65 cm | TL=44 cm |
| TL=57 cm | TL=39 cm |

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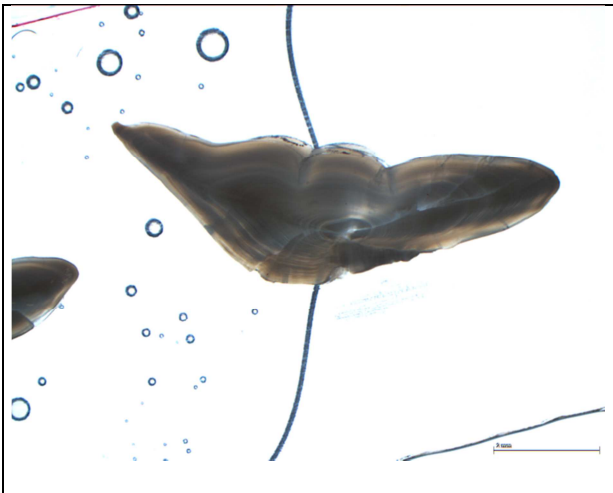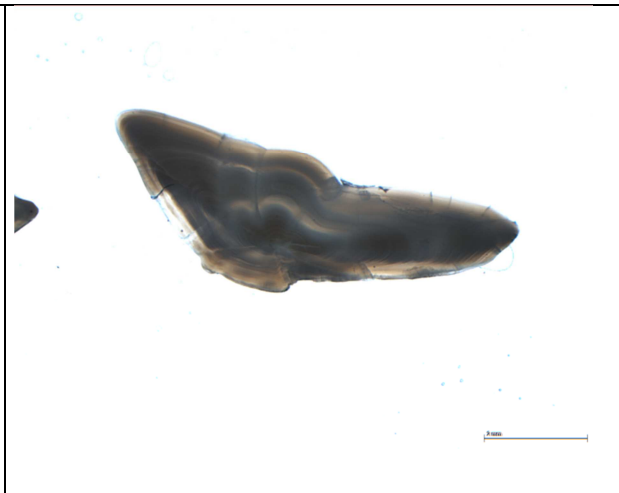
**Age group 3**

| | |
|---|---|
|  |  |
| TL=76 cm | TL=78 cm |
|  |  |
| TL= 88 cm | TL=78 cm |

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# Quarter 3 : Otoliths from fish market (Lorient)

## Age group 1



| |
|---|
| TL=43 cm |

## Age group 2
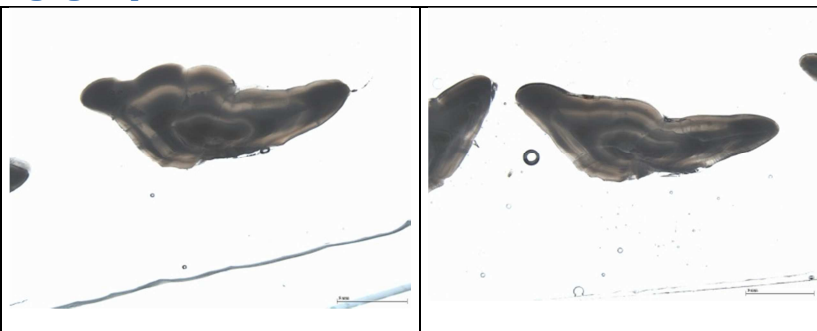


| TL=63 cm | TL=74 cm |
|---|---|

## Age group 3



| TL=78 cm | TL = 88 cm |
|---|---|

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## Age group 4



| TL=92 cm | TL=86 cm |
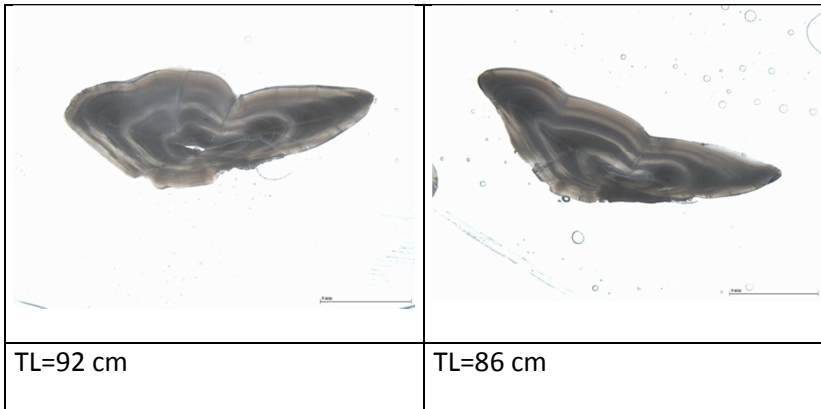
## Quarter 4 : Otoliths from survey at sea (EVHOE)

### Age group 1



| Male TL=37 cm | Female TL=41 cm |

### Age group 2

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| FemaleTL= 81 cm | Male TL= 51 cm |
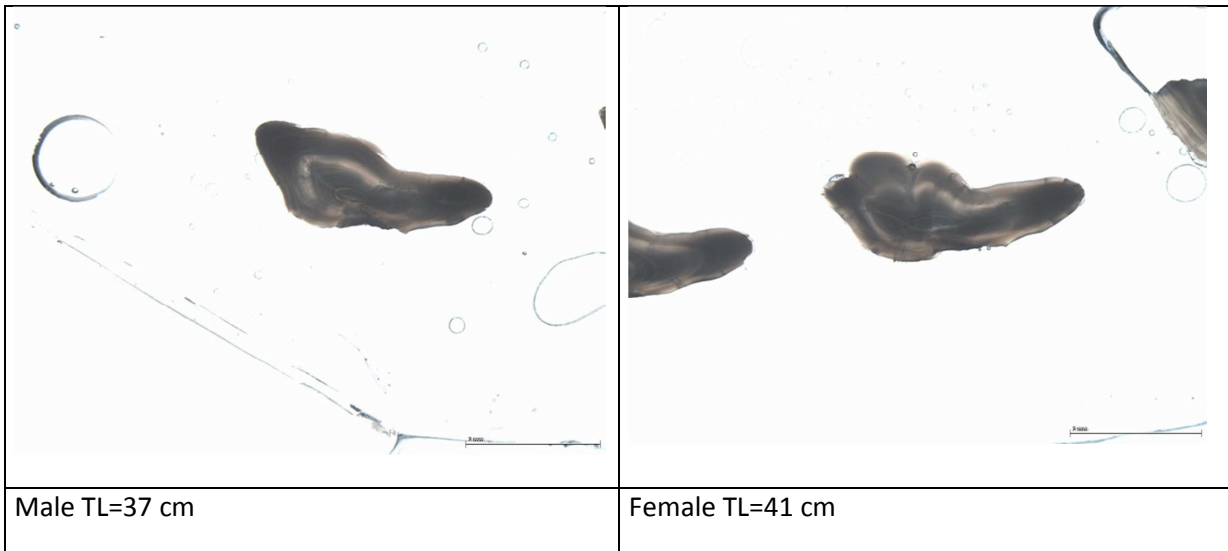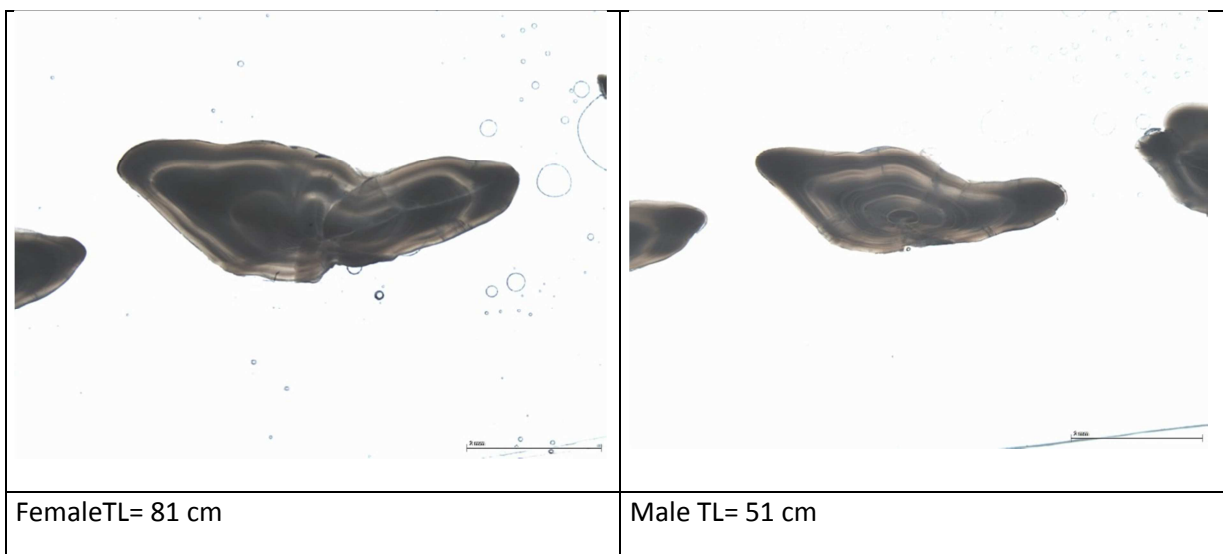
## 7. REFERENCES

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Eltink, A. T. G. W., Newton, A. W., Morgado, C., Santamaria, M. T. G., Modin, J., 2000. Guidelines and Tools for Age Reading. (PDF document version 1.0 October 2000) Internet : http://www.efan.no

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