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**DATRAS Procedure Document**  
**BITS indices calculation procedure**

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## General

Two types of data are used to estimate CPUE per length per haul. HH data provide information about the position, the depth and the duration of the haul beside additional parameters "DataType" (See [Annex 1](#)) and "Validity" of the haul. CPUE values are only estimated for hauls with validity codes "V" and "N" and for species with species validity code "SpecValCode" 1 or NULL (See [Annex 2](#)).

The length frequencies of sampled individuals by haul and species are stored in the HL data. In case of large catches, subsampling is indicated by Subfactor > 1 (See [Annex 1](#)).

HL data are used to estimate the number of individuals per length class and hour for each valid haul (CPUE per length and haul). In case of cod (*Gadus morhua*), conversion factors are used to transfer the CPUE values of the national and the small TVS into CPUE values of the large TVL. The conversion factors are available at [Annex 3](#).

The CPUE values per depth layer (SubArea) presents the arithmetic mean of the CPUE per length per haul of all hauls in the same depth layer and the CPUE per length per SD (Area) are estimated as weighted mean of the CPUE per length per depth layer of all covered depth layers where the area of the depth layers are used as weighting factors (See [Annex 4](#)).

Following depth layers are used in the different SD's:

SD	0 – 19 m	20 – 39 m	40 – 59 m	60 – 79 m	80 – 99 m	100 – 120 m	120 – 200 m
22	x	x	x	x			
23	x	x	x				
24	x	x	x	x			
25		x	x	x	x	x	
26		x	x	x	x	x	x
27		x	x	x	x	x	
28		x	x	x	x	x	x

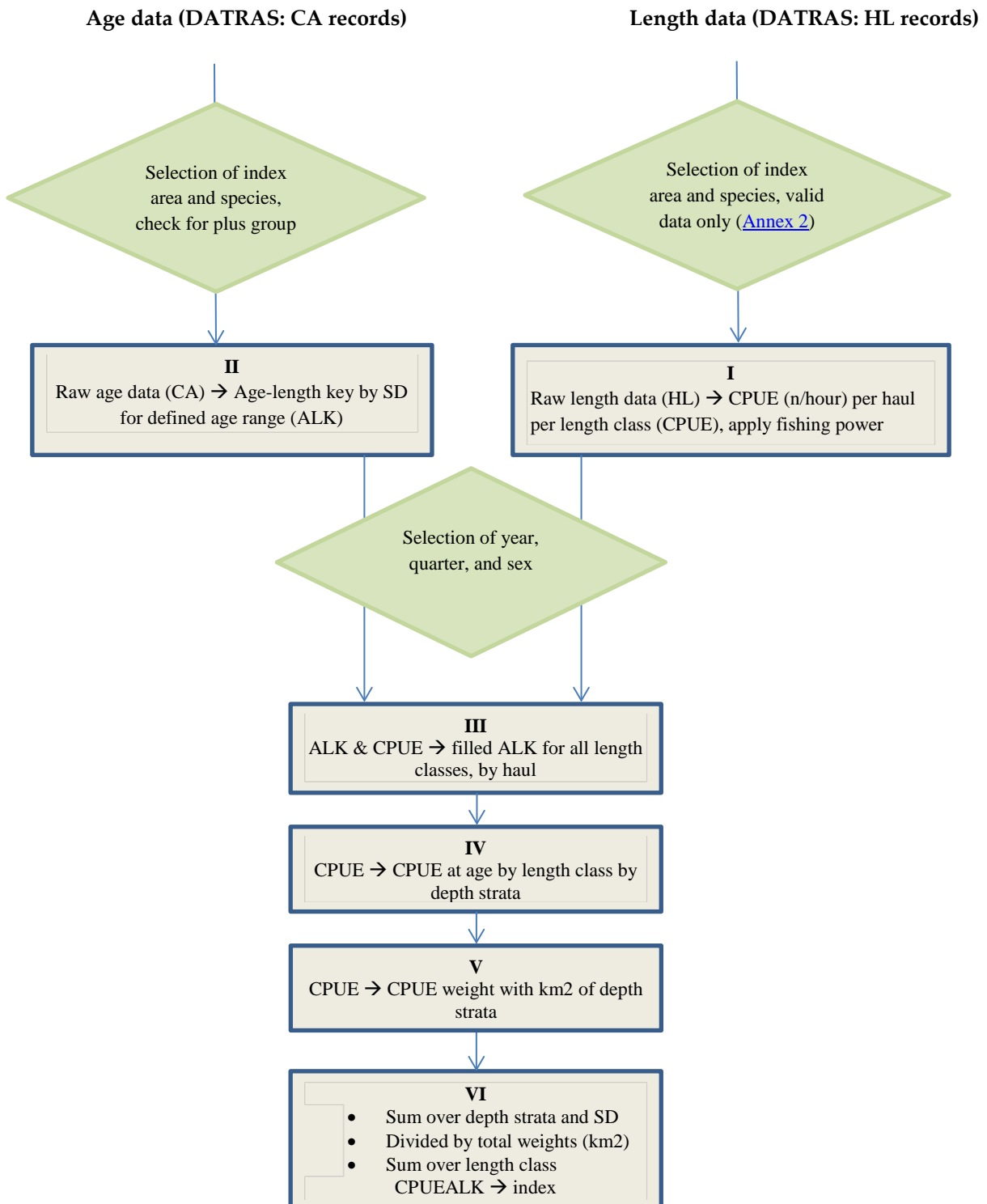
Age-length keys (ALK) are estimated for ICES subdivisions (SD) based on the length and age data of individuals stored in the CA data. ALK of SD's are used to transfer the length based CPUE per haul depth layer or SD into CPUE per age per haul, CPUE per age per depth layer and CPUE per age per SD. Alternatively the CPUE per age per haul can be used to estimate the CPUE per age per depth layer and CPUE per age SD by means of the same procedures used for length based CPUE. The mathematical background for the estimation of CPUE values of different aggregation levels is given in the BITS manual ([Annex 5](#)).

## Flow diagram. BITS Data Products Step-by-Step

In BITS, the indices are calculated per index area, which are specific for each species.

First the mean age at length per depth stratum and sub-division (where CPUE at length per haul have been weighted by fishing power for each research vessel) are calculated and weighted with  $\text{km}^2$  of the stratum. From these means mean at age per sub-division is calculated and then the mean per index area is derived.

### Flow diagram from DATRAS Exchange data to year class index, BITS



## Data processing

### I. Raw length data (HL) -> CPUE (n/hour) per haul per length class (CPUE)

Extraction of raw length data

Species recording code is taken into account. If Bycatch species recording codes exist for a species then only hauls with all species reported or the selected species record is selected. If NO Bycatch species recording code exists for a species then all hauls are selected. If there is standard species then take only haul which has data of that standard species

- Include only valid and non-oxygen haul data
- Calculate number of valid hauls per SubArea
- Check for day/night code (See [Annex 6](#))
- Handle zero hauls and Select species in question where specimen are NOT caught
- Raise data from sub sampling to total number per haul, select valid data and multiply the number at length with the sub sampling factor for each category and sex
- Sum number at haul over category and sex
- If data type is not CPUE then  $\text{NoAtHaul} * 60 / \text{HaulDuration}$
- CPUE are converted to standard trawl by multiplying with a conversion factor ( See [Annex 3](#))

### II. Raw age data (CA) -> Age-length key by SD for defined age range (ALK)

- Extraction of ALK data: haul based ALK for all selected haul from process 1, area based ALK
- Check if plus group (e.g. ages 1, 2, 3, 4+) is equal to or below the maximum age for that species (See [Annex 6](#)), if so then plus group is used in the further calculations and it becomes the new plus group
- All age below plus group and greater then/equal to plus group are summed by lengthclass and age
- Combines the data with the ALK and insert 0 for null values. Age larger than plus group are summed to plus group age and set ALK = 0 for age 0 if quarter = 1

### III. ALK & CPUE -> filled ALK

- Combining ALK with catch at length
- If there is no ALK for a length for which there are catches recorded then there are three possibilities for obtaining age information for that length class:
  1. If length is less than min length in (See [Annex 6](#)) then the age is set to age 1 in first quarter and 0 in all other quarters.
  2. If length is between min length and max length then age is set to the nearest ALK either at a length class before or at a length class after the one which misses an ALK. If there is one below and one after the length class at equal distance in length a mean is taken
  3. If the length is larger than max length the age is set to the plus group if there is no ALK.

### IV-VI. CPUE -> index

- Calculating a mean CPUE per age and length by stratum
- For indices, mean CPUE per age and length per depth stratum is weighted (See [Annex 4](#)) with the area of a depth stratum in km<sup>2</sup>
- CPUE per age is summed over all depth stratum
- The index is calculated as the total CPUE in index area is divided by total area in index area

## **BITS data product calculation**

See [Annex 5](#), page 13

## **Annex 1. DataType**

[https://datras.ices.dk/Data\\_products/FieldDescription.aspx?Fields=DataType&SurveyID=2826](https://datras.ices.dk/Data_products/FieldDescription.aspx?Fields=DataType&SurveyID=2826)

## **Annex 2. Haul validity**

[https://datras.ices.dk/Data\\_products/FieldDescription.aspx?Fields=HaulVal&SurveyID=2826](https://datras.ices.dk/Data_products/FieldDescription.aspx?Fields=HaulVal&SurveyID=2826)

- 1: Valid and NonOxygen haul
- 2: SpecValCode = 1 OR NULL
- 3: IF SD=21,25,27,28,29,30,31,32 Then Depth range<>'0-19'AND<>'120-200'
- IF SD= 22,23,24 Then Depth range<>'120-200'
- IF SD= 26 Then Depth range<>'0-19'

## **Annex 3. Conversion factor of gear to TVL**

([https://datras.ices.dk/Documents/Manuals/ConversionFactor\\_TV.L.csv](https://datras.ices.dk/Documents/Manuals/ConversionFactor_TV.L.csv))

## **Annex 4. Area weights**

(<https://datras.ices.dk/Documents/Manuals/AreaWeights.csv>)

## **Annex 5. BITS Manual 2011**

[https://datras.ices.dk/Documents/Manuals/Addendum\\_1\\_WGBIFS\\_BITS\\_Manual\\_2011.pdf](https://datras.ices.dk/Documents/Manuals/Addendum_1_WGBIFS_BITS_Manual_2011.pdf)

## Annex 6. Lookup table for individual indexarea

Index area	Quarter	MaxAge	MinLngt	MaxLngt	AggAreaALK	AggAreaCPUE	LngtCode	LngtClass	AreaWeight	DayNight
BS_CodEast	1	10	140	900	TS_SubDiv	StatRec	2300	1500	1	0
BS_CodWest	1	10	140	900	TS_SubDiv	StatRec	2300	1500	1	0
BS_Flounder25	1	10	30	450	Ts_SubDiv	StatRec	2300	600	1	0
BS_Plaice	1	10	40	600	TS_SubDiv	StatRec	2300	1500	1	0
BS_Plaice_Exc_Katt	1	10	40	600	TS_SubDiv	StatRec	2300	1500	1	0
BS_CodEast	4	10	70	900	TS_SubDiv	StatRec	2300	1500	1	0
BS_Flounder25	4	10	70	450	TS_SubDiv	StatRec	2300	600	1	0
BS_Plaice	4	10	40	600	TS_SubDiv	StatRec	2300	1500	1	0
BS_Plaice_Exc_Katt	4	10	40	600	TS_SubDiv	StatRec	2300	1500	1	0
BS_CodEast	1	10	140	900	TS_SubDiv	StatRec	2300	1500	1	0
BS_CodWest	1	10	140	900	TS_SubDiv	StatRec	2300	1500	1	0
BS_Flounder25	1	10	30	450	Ts_SubDiv	StatRec	2300	600	1	0
BS_Plaice	1	10	40	600	TS_SubDiv	StatRec	2300	1500	1	0
BS_Plaice_Exc_Katt	1	10	40	600	TS_SubDiv	StatRec	2300	1500	1	0

## Versions

Version Number	Release Date	Note
1.1	1/12/2013	Original version issued by ICES Data Centre