

### ***Morphological measurements on large gulls***

This document describes morphological measurements on large gulls (*L. argentatus*, *L. cachinnans* and *L. michahellis*, to some extent also on members of *L. fuscus* clade), which we use since nearly 10 years in our studies.

No special equipment is necessary to complete the full set of measurements – you need only a ruler (50 cm long, it's good to use shorter one – say, 20 cm long – to measure black and white portions on outer primaries) and a caliper. Very helpful is to use a printed table with all measurements listed that prevents from forgetting measurements. Processing of a single bird takes about 15-20 minutes.

Measurements to be taken on each individual are divided into three groups:

1. So-called basic measurements, describing body size and shape,
2. Measurements describing black-and-white portions on outer primaries – so called “wing-tip pattern”, and a mantle shade using the Kodak Grey Scale
3. Colour-based measurements, characterizing colouration of bare parts.

#### **Basic measurements** (see Fig. 3)

(r) – ruler, (c) – caliper

**HE** – total head length (c)

**BI** – bill length – measured from feathering to tip (c)

**HBIG** – bill depth at gonys (c)

**HBIN** – minimal bill depth between bill base and gonys (c)

**TR** – tarsus length (c)

**MT** – middle toe length (c)

**WI** – wing length (r)

**HA** – hand length – the distance between the tip of P1 and the tip of P10 (to be measured only if moult has not started yet) (r)

#### **Wing-tip measurements**

All lengths are taken with a ruler.

**NB** – number of primaries with black colour near the tip (called also “black-tipped primaries”); all primaries with even slight dark spots near the tip should be counted;

**TI** – pattern of black on the innermost primary with black: 1 – dark spot present on one side of the feather only, 2 – incomplete black bar, 3 – complete black bar (see Fig. 1D);

**T10** – pattern of the tip on P10, describes the development of the black subterminal bar on P10: 1 – complete white tip, black part separating tongue from the tip broken (‘*thayeri*-pattern’), 2 – complete white tip, 3 – small black spots near the tip, 4 – incomplete black bar and 5 – complete black bar (see Fig. 1A and photo);

**T9** – pattern of the tip on P10, describes the development of the white mirror on P9: 1 – white mirror connected with the tongue (‘*thayeri*-pattern’), 2 – large white mirror, reaching both feather’s edges, 3 – white mirror reduced, does not reach one or two feather’s edges, 4 – white mirror small, on one feather’s web only, 5 – no white mirror (see Fig. 1B and photo);

**TN** – colour of the tongue on the inner web of P10: 1 – white or whitish, 2 – grey, but paler than the mantle, 3 – grey, as dark as the mantle (see photo);

**W10** – length of white tip of P10 (see Fig. 1C and photo)

**W9** – length of white section on P9, between the beginning of the white mirror and the feather’s tip (see Fig. 1C and photo),

**B10** – length of black part on P10, between the distal edge of the tongue and the beginning of the white tip (see Fig. 1C and photo),

**B9** – length of black part on P9, between the distal edge of the tongue and the beginning of the white spot (see Fig. 1C and photo),

**B8** – length of black part on P8, between the distal edge of the tongue and the beginning of the white tip (see and photo),

**B7** – length of black part on P7, between the distal edge of the tongue and the beginning of the white tip (see photo),

**B6** – length of black part on P6, between the distal edge of the tongue and the beginning of the white tip (see photo),

(**B5** – measure as above if black is present and measurable)

Note, that an extreme reduction of black parts on P9 and/or 10 is the Goethe's 'thayeri-pattern' (reminiscent of *Larus thayeri*). In that case, black portion of the primary does not touch inner web and it is impossible to measure B10 and/or B9 – please put value 0. Note also that all measurements of black and white parts (W9, W10, B6-B10) are always measured along the feather's shaft.

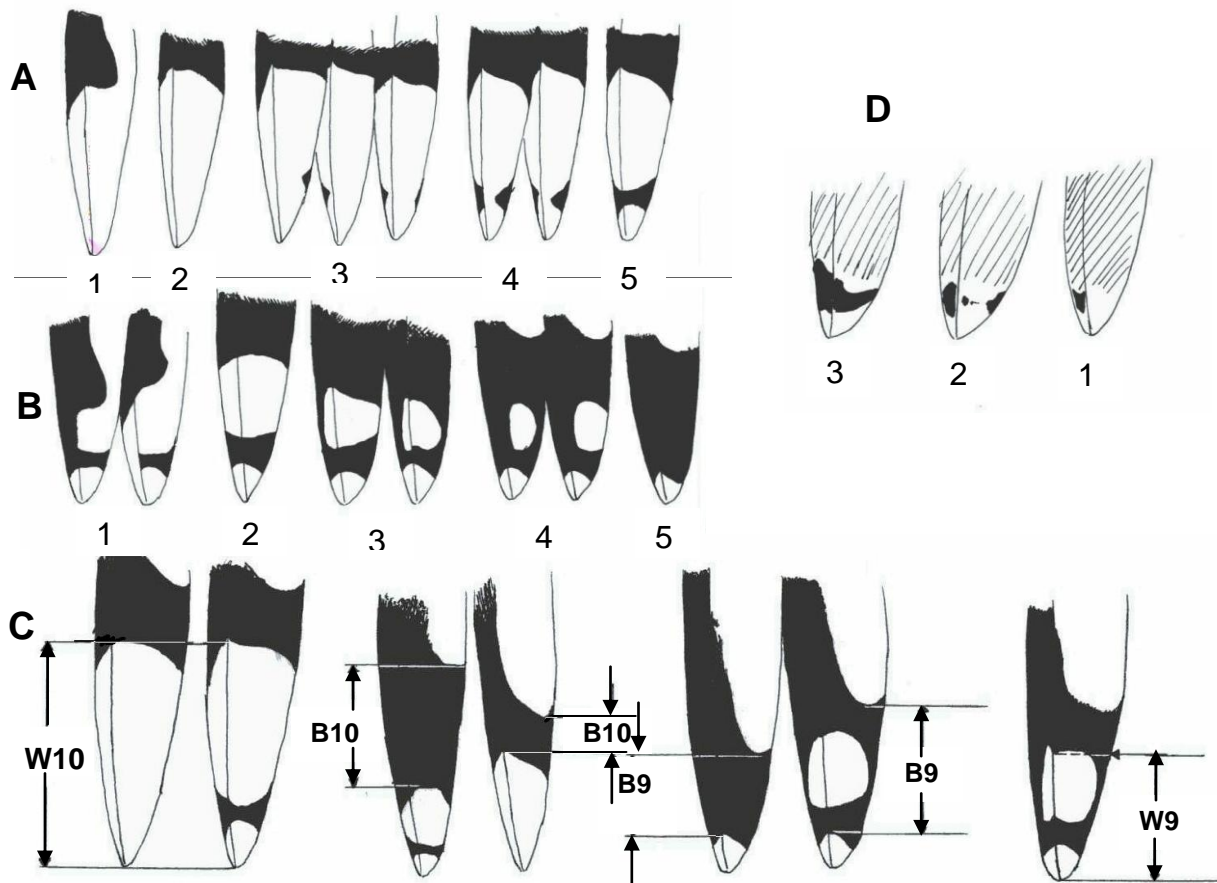


Fig. 1. Wing-tip pattern measurements. **A** – pattern of the tip on P10 – development of subterminal bar (1 – 'thayeri-pattern', 2 – complete white tip, ..., 5 – complete subterminal bar); **B** – pattern of white on P9, development of white mirror (1 – 'thayeri-pattern', 2 – large mirror, ..., 5 – no white mirror); **C** – measurements of black and white on P9 and P10. **W10** – length of the white tip on P10; **B10** – length of black part on P10, between distal end of the tongue and white tip of the feather; **B9** – length of black part on P9; **W9** – length of white part on P9 (measured from the beginning of the white mirror to the end of the feather; if no white mirror is present [T9=5], W9 = 0). Black parts on P6 to P8 are measured in a similar way: from the distal end of the tongue to the beginning of the white tip, always along the shaft. **D1-3** – pattern of black on the innermost primary with black: 1 – dark/black spot only, 2 – incomplete bar, 3 – complete bar).

## Colour-based measurements

### *Iris pigmentation*

Five-step scale is proposed (Fig. 2): 1) no dark spots, 2) 1-10% of the iris area covered by dark spots, 3) 11-50%, 4) 51-90% and 5) > 90% of the iris area covered by dark spots. Note that you estimate only the total area of the iris that is covered by dark spotting, irrespective of the spots' shape and form (compare two irides scored as 4 on Fig. 2).

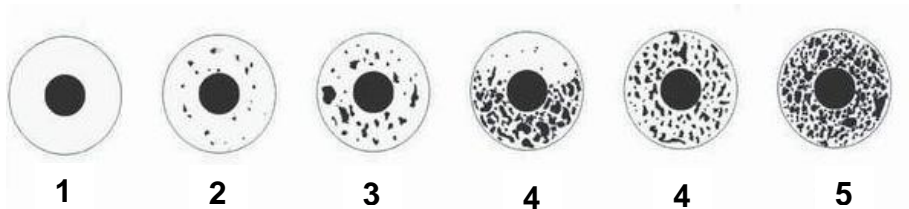


Fig. 2. Iris pigmentation.

### *Leg colour*

Five step scale is proposed for leg colour: 1) grey, greenish, green-grey, pale, „colourless”, 2) fleshy pink, 3) fleshy pink with yellow shades, 4) yellow, 5) intensive yellow. Please note colours separately for tarsus, swimming web and toes – they sometimes differ.

### *Eye ring (orbital ring) and gape colour*

Four-step scale is proposed, which, if necessary can be more precise if half-steps are assigned (2.5 for orange colour or 1.5 for colour intermediate between yellow and pale orange, etc.): 1) yellow, 2) pale-orange, 3) dark-orange and 4) reddish to red.

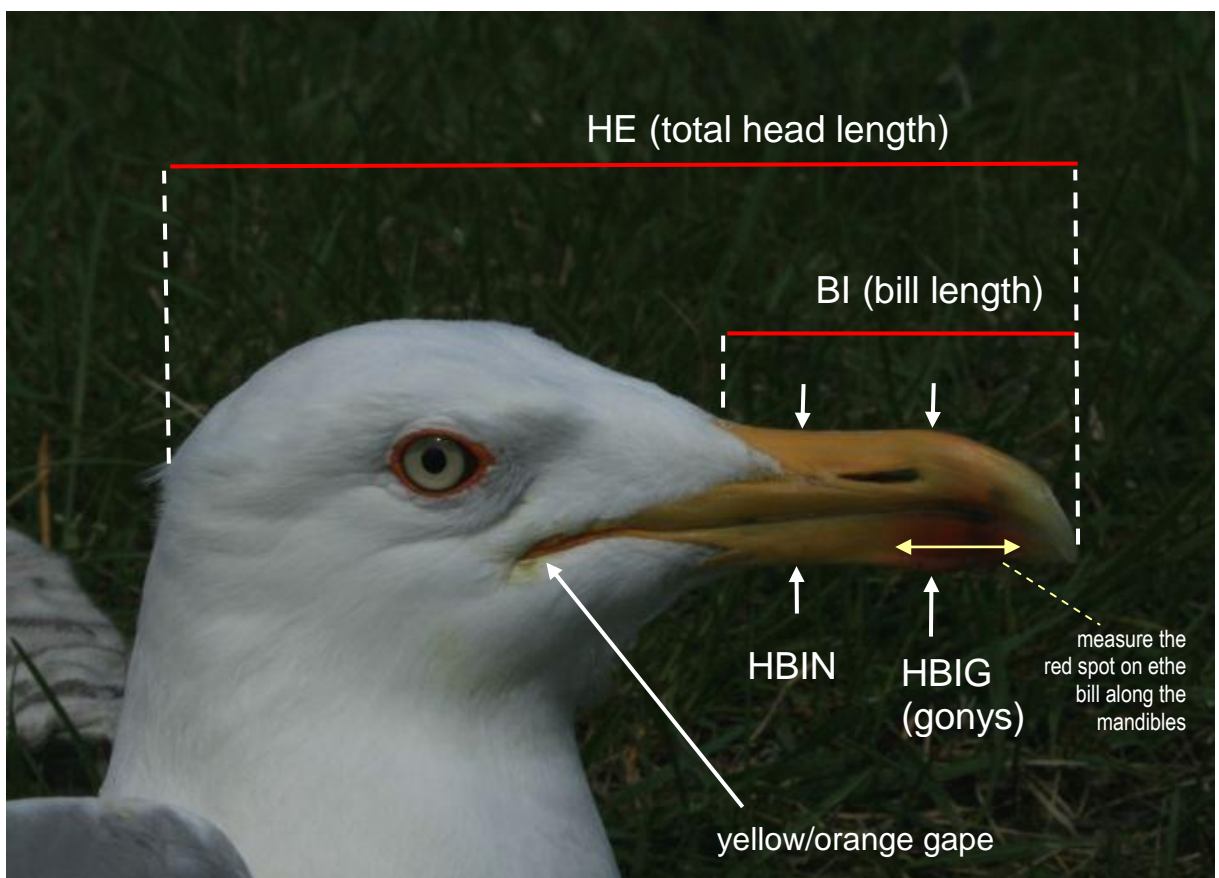
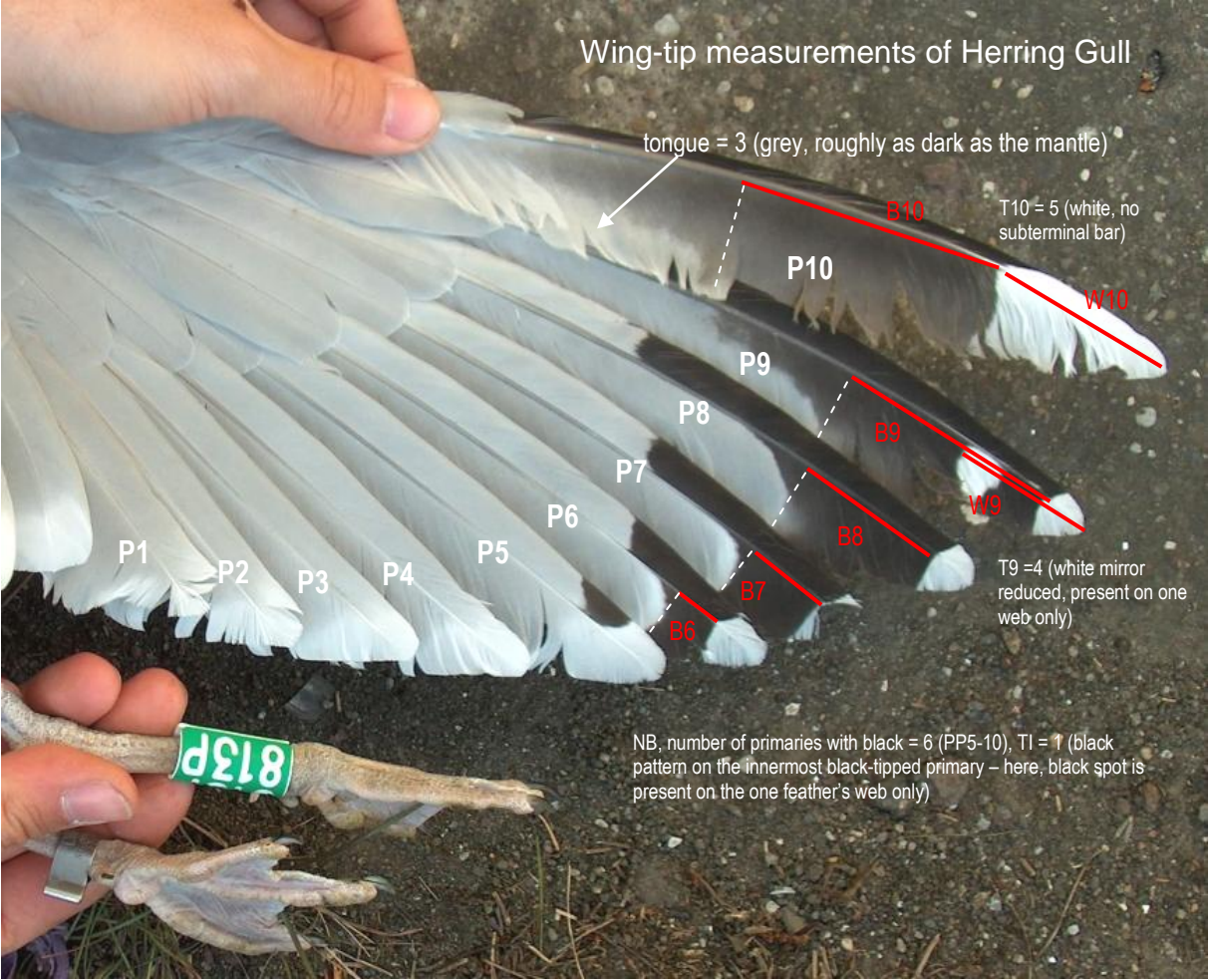
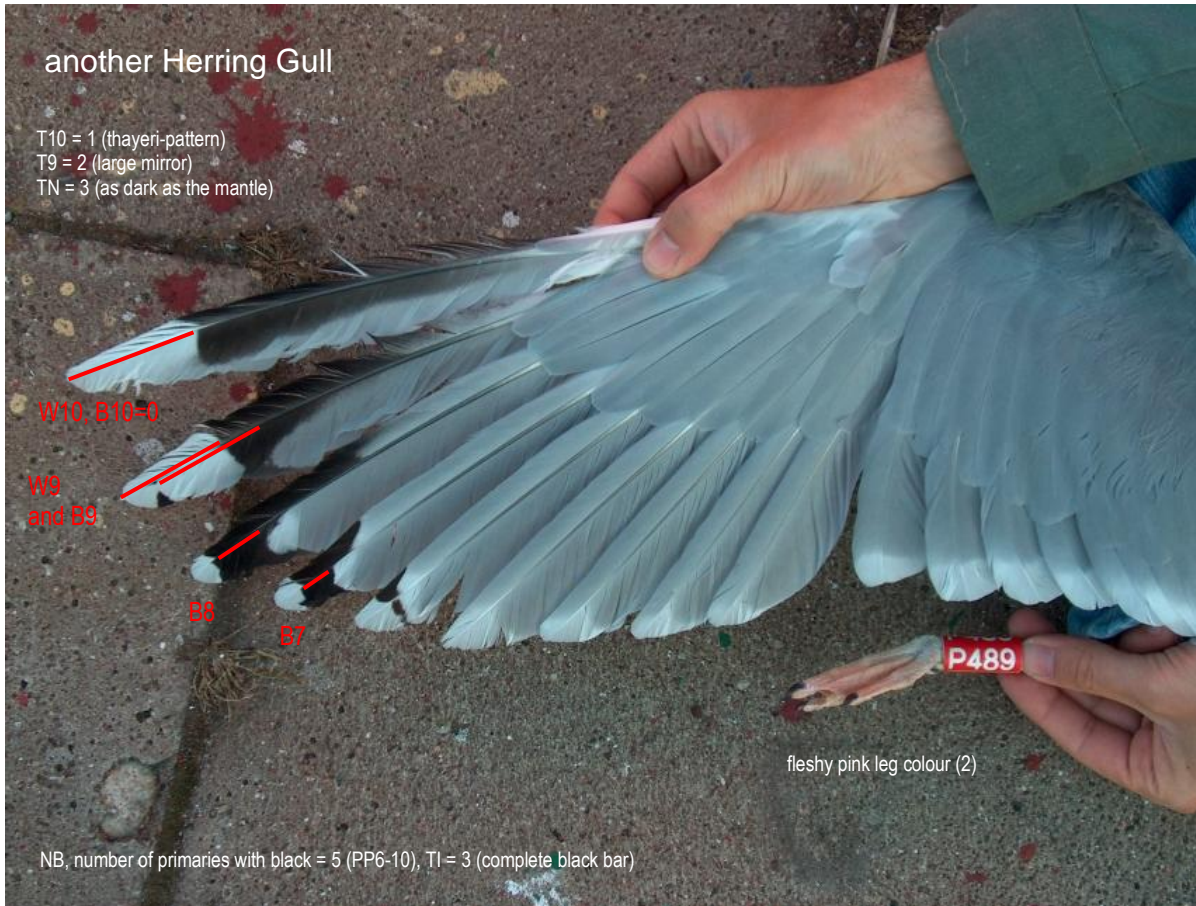


Fig. 3. Basic head measurements





*Iris pigmentation and eye ring colour examples*



**A** Iris = 2 (single dark spots)  
Eye ring = 1 (yellow)

**B** Iris = 4, eye ring = 2 (yellow) or 2.5 (yellow/orange)

**C** Iris = 1 (no dark spots), eye ring = 2.5 (orange)



**D** Iris = 4, eye ring = 3 (dark orange)

**E** Iris = 5 (all dark), eye ring = 3

**F** Iris = 1 (no dark spots), eye ring = 1 (yellow)

A, C and F are typical *argentatus*, B is hybrid, D and E are typical *cachinnans*

Apart from the above measurements it is good to measure additionally:

- body mass,
- whether a bird is moulting primaries and how many (left and right wing separately),
- immaturity signs (all brown/dark traces on the alula, coverts, rectrices),
- whether any dark is present on bill (separately for upper and lower mandibles),
- the red spot on the bill extends onto the upper mandible; measure it along the bill – see fig. 3