White-beaked Dolphin body coloration patterns

- Juveniles have light grey beaks, and any of the following: speckling, semi-circular head blaze and lateral patch
- Adults have fully-developed blowhole chevron, completely filled-in post-ocular crescent, continuous dorsal flank blaze, peduncular saddle, dark grey abdominal field, beak blaze of dark grey colour with white or pink tip, and flipper stripe as a demarcation line between white throat chevron and grey post-ocular crescent

Source: Bertulli et al., 2016
White-beaked Dolphin distribution in North Atlantic

• Cold temperate & low arctic
• mainly 50-100 m depth, but in Barents Sea, 15-200 & 400 m, & W Greenland, 300-1,000+ m
• mainly 2-13°C
White-beaked Dolphin population structure

- mtDNA analysis indicated three management units in Europe: British Isles/Netherlands, northern Norway and Iceland, with a separate one in the NW Atlantic
- Moderate haplotype diversity ($h=0.73$) from mt D-loop
- Low nucleotide diversity ($\pi=0.0056$) indicating past bottleneck

- Some sub-structuring in white-beaked dolphin compared with white-sided dolphin, based on RADSeq of whole genome
- Observed heterozygosity = 0.012
- Low nucleotide diversity ($\pi=0.03$)

**Source:** Evans & Teilmann, 2009; Banguera-Hinestroza *et al.*, 2010

**Source:** Fernandez *et al.*, 2015
White-beaked Dolphin abundance estimates

Sources: CETAP, 1982; Øien, 1996; Lawson & Gosselin, 2009; Pike et al., 2009; Hansen & Heide-Jørgensen, 2013; Pike et al., 2019; Hammond et al., 2021; Gilles et al., 2023
White-beaked Dolphin population trends

Total Abundance: July 2016: 36,287 (CV=0.29; 95% CI: 18,694-61,869)
July 2005/07: 37,689 (CV=0.36)
July 1994: 23,716 (CV=0.30)

Estimated Annual rate of change:
-0.5% (95% CIs: -18; 22%), p=0.82 (CV=0.36)

Source: Hammond et al. (2017)
White-beaked Dolphin seasonal densities in NW Europe

Source: Waggitt et al. (2020)
White-beaked Dolphin Strandings in North Sea

Source: IJsseldijk et al., 2018
White-beaked Dolphin Strandings in North Sea

Source: IJsseldijk et al., 2018
White-beaked Dolphin Strandings in North Sea

Source: IJsseldijk et al., 2018
ANNUAL CYCLE OF THE WHITE-BEAKED DOLPHIN

Gestation Period: c. 11 months
Lactation Period: ??
Calving Interval: ??
White-beaked Dolphin Life History Parameters

Growth & Reproduction

- Length at birth is 110-120 cm at c. 40 kg weight
- Males become sexually mature at 230-260 cm length and 8-12 years of age
- Females become sexually mature at 230-240 cm length and 6-8 years of age
- Adult males average 273 cm length (range 252-290 cm), up to 354 kg
- Adult females average 251 cm (range 242-265 cm), up to 306 kg

Life Span

- Males at least 32 years
- Females at least 39 years

Sources: Kinze et al., 1997; Evans & Smeenk, 2008; Galatius et al., 2010; Galatius & Kinze, 2016; Galatius, Kinze & Evans, 2023
White-beaked Dolphin Group Sizes

Mean (Range) Group Size:  5.1 (1-220) – UK (Evans, 1992; Anderwald, 2002; Evans et al., 2003)
7.9 (1-300) – Faxaflói, SW Iceland (Bertulli, 2015)
10.0 (1-150) – Skjálfandi, N Iceland (Bertulli, 2015)
8.0 (1-150) – Barents Sea (Fall & Skern-Mauritzen, 2014)
8.6 (1-200) – Gulf of St Lawrence (Kingsley & Reeves, 1998)
9.1 (1-20) – Nova Scotia (Simard et al., 2006)
6.3 (1-100) – NASS Survey, Iceland (Pike et al., 2009)
White-beaked Dolphin Acoustics

- Audiogram from two free-living white-beaked dolphins indicate a hearing range of 16-181 kHz with peak sensitivity c. 50-64 kHz (Nachtigall et al. 2008)

- Highest hearing sensitivity of any dolphin recorded: 90 dB at 152 kHz and 111 dB at 181 kHz (Nachtigall et al., 2008)

- Very narrow echolocation beam width: 8° at 3 dB & 10° at 10 dB (Rasmussen et al., 2004)

- Echolocation clicks have average peak frequencies c. 115 kHz with a secondary peak c. 250 kHz, and a centre frequency at 82 kHz; click source levels 190-210 dB re 1μPa (Rasmussen & Miller, 2002; Rasmussen et al., 2002)

- Burst pulse signals also made at 719 Hz (range 423-1,103 Hz) with mean peak frequency of 35.3 kHz (Simard et al., 2008)

- Whistles range from 3-35 kHz with few having harmonics; duration 0.03-1.62 s. (Rasmussen & Miller, 2002)
White-beaked Dolphin Behaviour

• Frequently bow-ride vessels, breach, and may cooperatively herd pelagic fish (Evans, 1987)

• Swim speeds average 6-12 km/hr, but can attain 30 km/h (Evans & Smeenk, 2008)

• Mean dive depth was 24 m for tagged individual in Iceland, with max. dive depth of 45 m in dives of up to 78 sec (Rasmussen et al., 2013)

• More than 50% of dives apparently to sea floor (Rasmussen et al., 2013)

• Travel great distances: one recognisable individual re-sighted 361 km away in only 6 days (Tetley, 2004); a satellite tagged male ranged over large areas of Iceland between the Westfjords and Faxaflói (Rasmussen et al. 2013); and movements recorded between Faxaflói, Breiðafjörður and Skjálfandi (Tetley 2006; Bertulli 2010, Bertulli et al. 2015)
White-beaked Dolphin Social Structure

- Highly fluid coefficients of association with few long-term bonds
- Association patterns best described as casual acquaintances
- A fall in lagged association rates suggest that individuals may separate after c. 10 days
- However, some associations last through study period

Source: Bertulli (2015)
## White-beaked Dolphin Threat Matrix

<table>
<thead>
<tr>
<th>POLLUTION &amp; OTHER CHEMICAL CHANGES</th>
<th>Greater North Sea</th>
<th>Celtic Seas</th>
<th>NE Atlantic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminants</td>
<td>M</td>
<td>M</td>
<td>M</td>
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<tr>
<td>Nutrient enrichment</td>
<td>L</td>
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<thead>
<tr>
<th>PHYSICAL LOSS</th>
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<tr>
<td>Habitat loss</td>
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<tr>
<th>PHYSICAL DAMAGE</th>
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<tbody>
<tr>
<td>Habitat degradation</td>
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<tr>
<th>OTHER PHYSICAL PRESSURES</th>
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<tbody>
<tr>
<td>Litter (inc. microplastics and discarded fishing gear)</td>
<td>L</td>
<td>L</td>
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<td>Underwater noise changes</td>
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<td>Military Sonar</td>
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<td>Seismic surveys</td>
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<td>Pile-driving</td>
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<td>Shipping</td>
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<tr>
<td>Barrier to species movement (offshore windfarm, wave or tidal device arrays)</td>
<td>L</td>
<td>L</td>
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<tr>
<td>Death or injury by collision</td>
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<tr>
<th>BIOLOGICAL PRESSURES</th>
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<tr>
<td>Introduction of microbial pathogens</td>
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<td>L</td>
<td>L</td>
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<tr>
<td>Removal of target and non-target species (prey depletion)</td>
<td>M</td>
<td>M</td>
<td>M</td>
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<tr>
<td>Removal of non-target species (marine mammal bycatch)</td>
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<tr>
<td>Disturbance (e.g. wildlife watching)</td>
<td>L</td>
<td>L</td>
<td>L</td>
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<tr>
<td>Deliberate killing + hunting</td>
<td>L</td>
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</table>

**Source:** Updated from ICES, 2015
White-beaked Dolphin Health Status

• Of 89 PMEs in the UK from 1990-2011, 29 (33%) were live strandings, 14 (16%) had died of starvation, 9 (10%) of infectious disease, 8 (9%) of by-catch, 7 (8%) of physical trauma of unknown origin, 5 (6%) from dystocia (Deaville, 2013)

• Levels (mg/kg dry weight) of heavy metals from 28 ice entrapped indivs from Newfoundland ranged between 0.01-2.17 lead, 3.5-32.1 copper, 0.2-43.8 cadmium, 0.0-5.8 mercury, 0.0-20.2 selenium, and 43.5-136.0 zinc; 4.5-88.6 ∑DDT, 20.3-83.8 ∑oxaphenes, 9.6-87.0 for ∑PCBs, and 3.7-25.0 mg/kg wet wt ∑chlordanes (Muir et al., 1988)

• Levels of mercury ranged between 1.3-27 mg/kg wet wt in the UK (Law et al., 1991), and 5.7-220.7 mg.kg dry wt in Germany, and 229 mg/kg dry wt in French Channel (Anderson & Rebsdorff, 1976; Law et al., 1991; Siebert et al., 1999; Das et al., 2003)
White-beaked Dolphin Vertebral Deformities

72% (18 of 25 adults) in the North Sea had vertebral lesions associated with spondylosis deformans; 11 of these had pathologically fused vertebrae; 5/400 adults in Iceland had similar deformities

Sources: Galatius et al., 2009; Bertulli, 2015; Bertulli et al., 2015
Tattoo Skin Disease & Physical Traumata in White-beaked Dolphins in North Sea
Geographic Variation in White-beaked Dolphin Diet

(Sources: Sergeant & Fisher, 1957; Jonsgard & Christensen, 1968; Evans, 1987; Lick, 1994; Berrow & Rogan, 1996; Dong et al., 1996; Canning et al., 2008; Skern-Mauritzen et al., 2009; Jansen et al., 2010)
Temporal trends in fish prey species

North Sea Spawning Stock Biomasses

Source: ICES data
• Decline from c. 55,000 in mid-1980s to c. 25,000 in mid-2010s

Source: MERP Project
White-beaked Dolphin: Recommendations for ASCOBANS Parties to address in reviewing the Conservation Status of the Species (AC24)

• Studies of life history parameters (ages, lengths at sexual maturity, reproductive rates, life spans) from stranded & bycaught animals
• Better abundance estimates in the northern North Atlantic
• Further investigations of population structure
• Studies of diet through stomach contents, stable isotope and fatty acid analyses
• More contaminant studies
• Studies of likely effects of climate change

To facilitate joint analyses, a high priority should be an inventory of necropsy and other samples held by each country through liaison between stranding networks.
Thanks to Chiara Bertulli, Anders Galatius, Phil Hammond & Carl Kinze for additional unpublished information