THE ATLANTIC WHITE-SIDED DOLPHIN IN EUROPE: RESEARCH & CONSERVATION

Peter G.H. Evans

School of Ocean Sciences, University of Bangor & Sea Watch Foundation, UK
Cytochrome b analysis

- Suggested that Atlantic white-sided dolphin (*Lagenorhynchus acutus*) should be in a separate genus

Source: Le Duc et al., 1999
Atlantic White-sided Dolphin Systematics - 2

(a) Bayesian Tree using nuclear genes

(b) Bayesian Tree using nuclear genes excluding IRBP

(c) Bayesian Tree using non-coding genes

(d) Bayesian Tree using mt genes (Cyt-b & 16s)

Source: Banguera-Hinestroza et al., 2014
Atlantic White-sided Dolphin Systematics - 3

- Estimated biogeography based on the Island Bayesian Analysis. The proportional support for different areas at a given node is represented by pie charts.

- *L. acutus* and *L. albirostris* likely shared a common ancestor that arose in the North Atlantic around the Middle Miocene, predating the radiation of subfamilies Delphininae, Globicephalinae and Lissodelphininae.

Source: Banguera-Hinestroza et al., 2014
Atlantic White-sided Dolphin Systematics - 4

Source: Banguera-Hinestroza et al., 2014
Atlantic White-sided Dolphin Distribution in North Atlantic

- Cold temperate & low arctic
- mainly 100-300 m depth
- mainly 5-12°C (range 2-16°C)
Atlantic White-sided Dolphin Population Structure

- No evidence for phenotypic differences in skull characteristics between western and eastern North Atlantic

- mtDNA analysis indicated panmixia across the North Atlantic, although animals from the North Sea (East Scotland & Shetland) showed some genetic differentiation from the rest

- High haplotype diversity (h=0.93)

- Low nucleotide diversity ($\pi=0.009$) indicating past bottleneck

- North-eastern region of the North Atlantic may merit separate management

- Relatively low sub-structuring in white-sided dolphin compared with white-beaked dolphin, based on RADSeq of whole genome

- Observed heterozygosity = 0.010-0.012 from microsatellite analysis, with average gene diversity over 10 loci of 0.73

- Likely rapid population expansion after most recent glaciation (9,000-14,000 years ago).

Source: Mikkelsen & Lund, 1994; Evans & Teilmann, 2009; Banguera-Hinestroza et al., 2014
Atlantic White-sided Dolphin Abundance Estimates

Sources: Palka, 2012; Hammond et al., 2017; NAMMCO, 2018
# Atlantic White-sided Dolphin Abundance Estimates

<table>
<thead>
<tr>
<th>Location</th>
<th>Estimate</th>
<th>Date/Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>W North Atlantic south to Nova Scotia</td>
<td>30,000</td>
<td>late 1970s-early 1980s</td>
</tr>
<tr>
<td>(Winn &amp; Edel, 1982)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southern Gulf of Maine to Cabot Strait</td>
<td>27,000</td>
<td>July-Sept 1995</td>
</tr>
<tr>
<td>(Palka <em>et al.</em>, 1997)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gulf of St Lawrence</td>
<td>12,000+</td>
<td>July-Sept 1995</td>
</tr>
<tr>
<td>(Kingsley &amp; Reeves, 1998)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western North Atlantic</td>
<td>48,819</td>
<td>June-Aug 2011</td>
</tr>
<tr>
<td>(Central Virginia – Lower Bay of Fundy)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Palka, 2012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NW Scotland</td>
<td>96,000</td>
<td>July-Aug 1998</td>
</tr>
<tr>
<td>(21,371 west of Outer Hebrides &amp; 74,626 in Faroe-Shetland Channel)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Macleod, 2004)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCANS 3 Survey Area</td>
<td>15,500</td>
<td>July 2016</td>
</tr>
<tr>
<td>(Hammond <em>et al.</em>, 2017)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-NASS Survey</td>
<td>42,547</td>
<td>Summer 2015</td>
</tr>
<tr>
<td>(NAMMCO, 2018)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Atlantic White-sided Dolphin Densities in NW Europe

Source: MERP Project
Atlantic White-sided Dolphin Population Trends

Population Trend: Decline from c. 80,000 in mid-1980s to c. 20,000 in mid-2000s

Source: MERP Project (2018)

Total Abundance: July 2016: 15,510
(CV=0.72; 95% CI: 4,389-54,807)

Source: Hammond et al. (2017)

WBD = blue triangles; AWSD = red circles
ANNUAL CYCLE OF THE ATLANTIC WHITE-SIDED DOLPHIN

- **Gestation Period:** 10-12 months
- **Lactation Period:** 18 months
- **Calving Interval:** 2-3 years
Atlantic White-sided Dolphin Life History Parameters

Growth & Reproduction

• Length at birth is 110-120 cm at c. 25 kg weight
• Males become sexually mature at 230-240 cm length and 8-9 years of age
• Females become sexually mature at 201-222 cm length and 6-8 years of age
• Adult males average 250 cm length up to 280 cm & 230 kg
• Adult females average 224 cm length, up to 250 cm & 180 kg

Life Span

• Males at least 22 years
• Females at least 27 years

Sources: Sergeant et al., 1980; Perrin & Reilly, 1984; Addink et al., 1997; Reeves et al., 1999; Evans & Smeenk, 2008; Cipriano, 2017
Atlantic White-sided Dolphin Group Sizes

Average (Range) Group Sizes: 39 (1-500) – UK (Evans, 1992; Anderwald, 2002; Evans et al., 2003)
60 (1-544) – Faroe Islands (Bloch & Mikkelsen, 2009)
50-60 (1-500) – Newfoundland, Canada (Sergeant & Fisher, 1957)
42 (1-500) – Nova Scotia & Cape Cod (Winn & Edel, 1982)
52 (1-2,500) – New England, USA (Weinrich et al., 2001)
Atlantic White-sided Dolphin Acoustics

- Echolocation clicks are broadband sounds (30-40 kHz) but containing frequencies >100 kHz; (Schevill & Watkins, 1962; Hamran, 2014)

- Burst pulse signals such as buzzes and calls not well studied. They comprise concave calls, and are produced mainly during socialising (Hamran, 2014)

- Pure tonal whistles recorded in Nova Scotia and Massachusetts with dominant frequencies of 6-15 kHz (Steiner, 1981)

- Stereotyped whistles range from 11-20 kHz; duration 853 ms (Hamran, 2014)

  a) Whistles
  b) Clicks
  c) Buzzes
  d) Calls
Atlantic White-sided Dolphin Behaviour

- Sometimes bow-rides or stern-rides vessels; breaches are commonly observed; leaps at a shallow angle (Evans, 1987)

- May form mixed groups with other species, e.g. fin & humpback whales, pilot whales, white-beaked, common dolphins (Evans, 1982)

- Swim speeds average 5.7 km/hour (range 1.8-14.2 km/hour (Mate et al., 1994)

- Mean dive duration of a radio-tagged individual was 38.8 sec, and never more than 4 min, with 89% of its time spent underwater (Mate et al., 1994)

- A radio-tagged individual mainly occupied water of depths of between 18-90 metres (Mate et al., 1994)

- Probably can travel great distances: one satellite-tagged individual travelled 309 km in 64.3 hours (Mate et al., 1994)
Whaling

Over fishing

Entanglement in fishing gear

Ship strikes

Pollution

Active sonar

Shipping

Recreational disturbance

Climate Change

Wind farm construction
## Atlantic White-sided Dolphin Threat Matrix

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

**Source:** Updated from ICES, 2015
Faroese small cetacean catches: Atlantic White-sided Dolphins

Annual catches vary from 1-546, and have averaged 234 between 1998-2017 (total 4,683)

Catches made mainly in July-Nov

Sources:
Bloch & Mikkelsen, 2009; WDC, 2018
Atlantic White-sided Dolphin Health Status

- Of 79 PMEs in the UK from 1995-2015, 45 were live strandings, 9 had died with generalised bacterial infections, 6 starvation, 5 meningo-cephalitis, 4 bycatch, 4 *Brucella* infection, 1 circulatory failure, 1 bacterial pneumonia, 1 liver infection, 1 skeletal pathology, 1 parasitic gastritis, 1 stillborn (Bennett *et al.*, 2000; SAC, 2000; Jepson, 2005; Deaville & Jepson, 2011; Deaville, 2011, 2012, 2013, 2014, 2015)
- Mercury in liver of a juvenile from NW Ireland was relatively high (44 ng/g wet weight) (Law *et al.*, 1991)
- Maximum concentrations (ng/g lipid) have been 3,290 dieldrin, 145 HCB, 73 mirex, 63 lindane, 23,100 p, p’-DDE, 401 heptachlor epoxide, 767 oxychlordane, 1,230 cis-chlordane, and 7,020 trans-nonachlor, 19 µg/g zinc, 12 µg/g cadmium (Kuehl *et al.*, 1991, 1994; Borrell, 1993; Palka *et al.*, 1997; McKenzie *et al*, 1998; Das *et al.*, 2002)
Diet of Atlantic White-sided Dolphin

(Sources: Sergeant & Fisher, 1957; Katona et al., 1978; St. Aubin & Geraci, 1979; Sergeant et al., 1980; Evans, 1987; Couperus, 1997; Nottestad et al., 2001; Doksaeter et al., 2008; Hernandez-Milian et al., 2016)
Temporal trends in fish prey species

Spawning Stock Biomasses

**Whiting**

- Source: ICES data

**Herring**

**Mackerel**

Source: ICES data
Atlantic White-sided Dolphin: Research Questions

- Better abundance estimates across all areas of North Atlantic
- Genetic sampling in northern & north-eastern parts of range
- Studies of life history parameters (ages & lengths at sexual maturity, reproductive rates, life spans) from stranded & bycaught animals
- Studies of diet through stomach contents, stable isotope and fatty acid analyses
- Development of an audiogram for the species
- More contaminant studies
- Studies of likely effects of climate change
Thank you for listening