Photo-identification of individual humpback whales (Megaptera novaeangliae) using all available natural marks: implications for misidentification and automated algorithm matching technology

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https://researchportal.scu.edu.au/discovery/fulldisplay/alma9910128890003023 68/61SCU_INST:Research Repository
Document Version: Supplementary Material

Supplementary Material

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BBBC-NTSM-2007-3225


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BBRK-NTBS-SM-2007-2621


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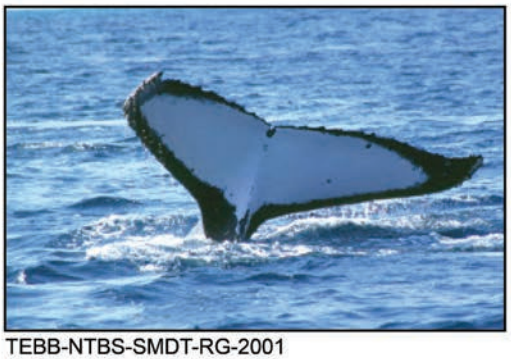
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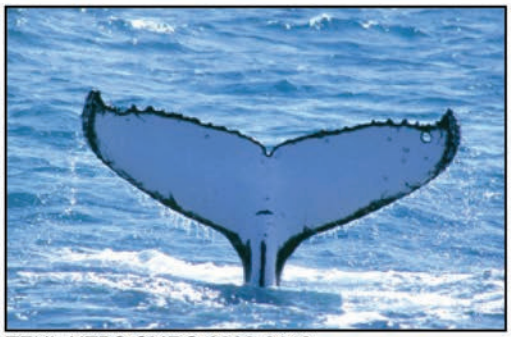
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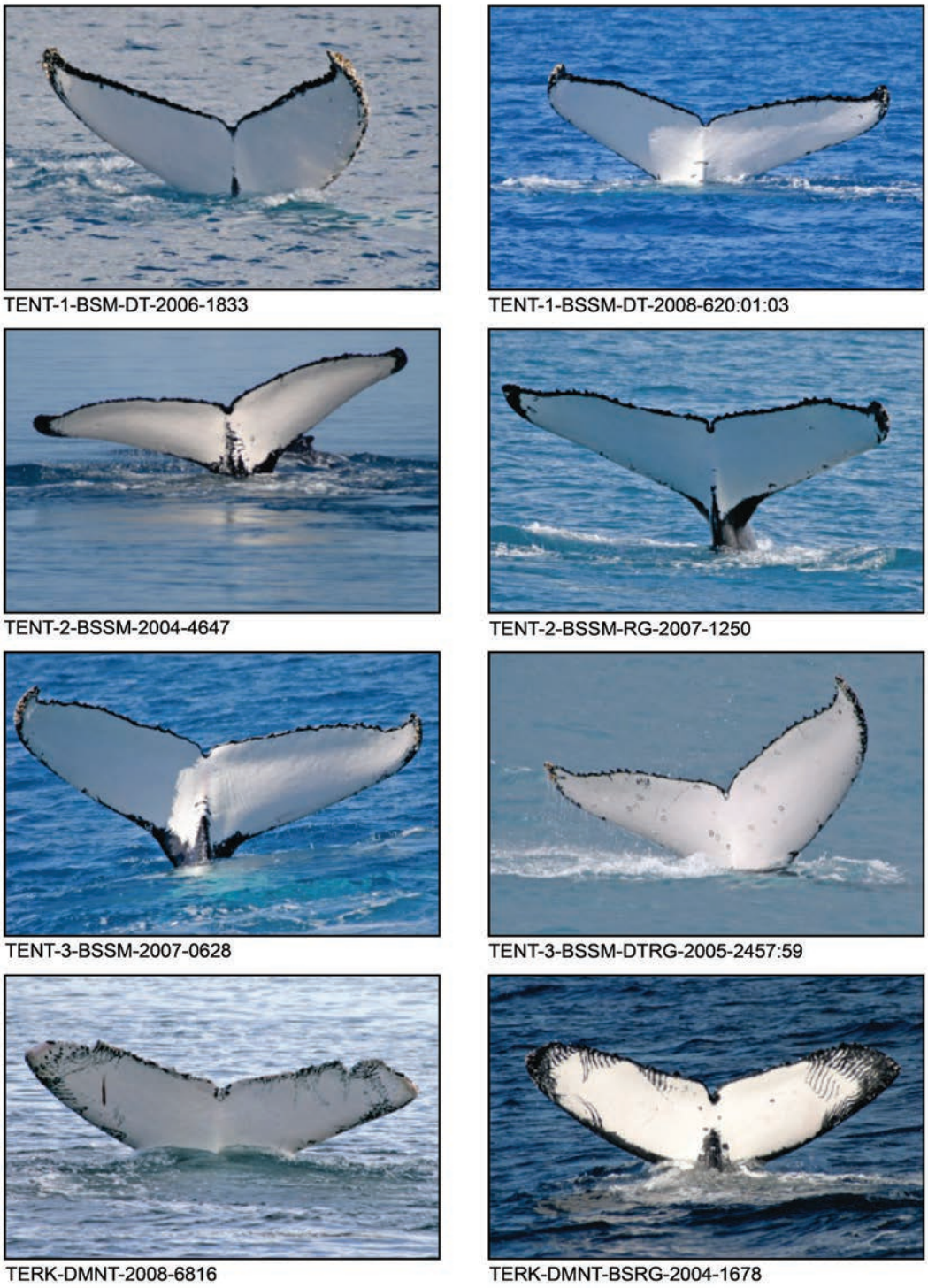


Supplementary Material Fig. 1. A selection of 24 fluke photographs illustrating how the ACDC code in the filename enhances visual display to facilitate photo-identification matching. Each filename is composed of the assigned ACDC codes, year photograph was taken and photo-identification image archive number of the ventral-tail fluke photograph.

Falcate high set, white patches - FH WP

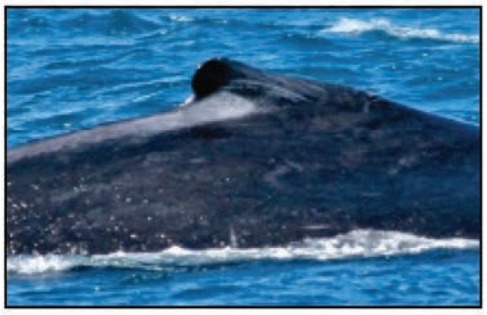
Falcate low set, scratch marks, rings - FL SM RG

Falcate fine pointed, whte patch - FP WP

Falcate low set, rake marks, rub marks - FL RK RM

Falcate low set, white patches - FL WP

Falcate rounded, white sides - FR WS



Rounded, grey spine - RN GS

Rounded, damaged - RN DM


Truncated, white patches - TR WP


Chipped, scratch marks - CP SM


Triangular, damaged, white patches - TR DM WP


Wedge, white patches, scratch marks - WD WP SM

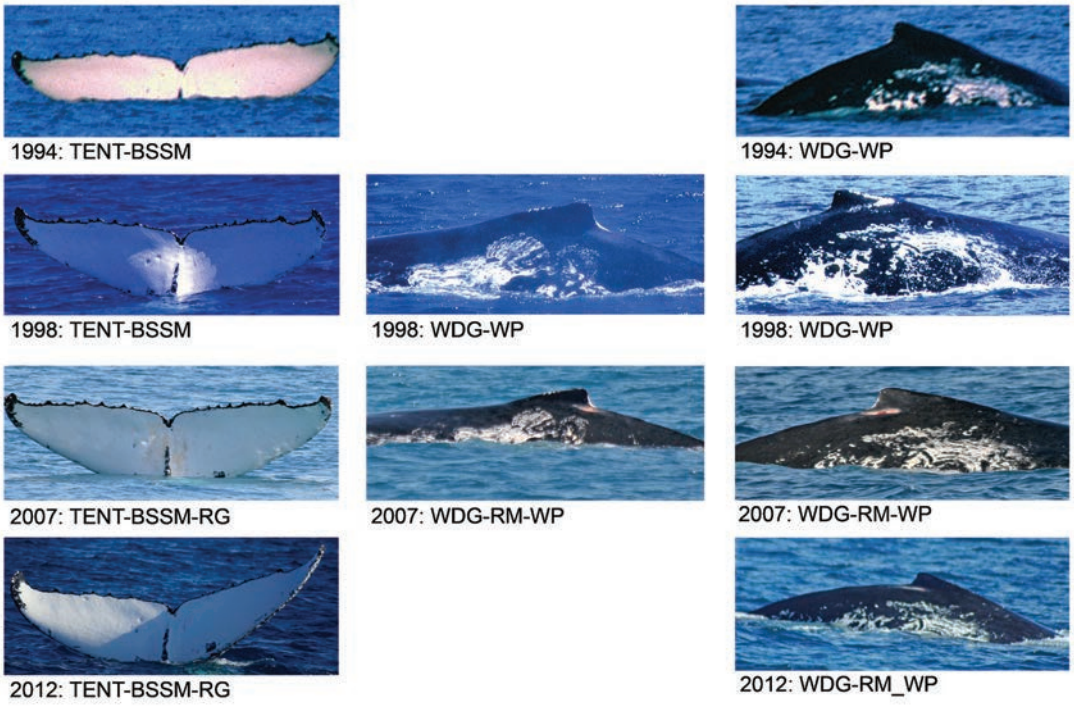

Wedge, rub marks, white patches - WD RM WP


Wedge, rub mark - WD RM

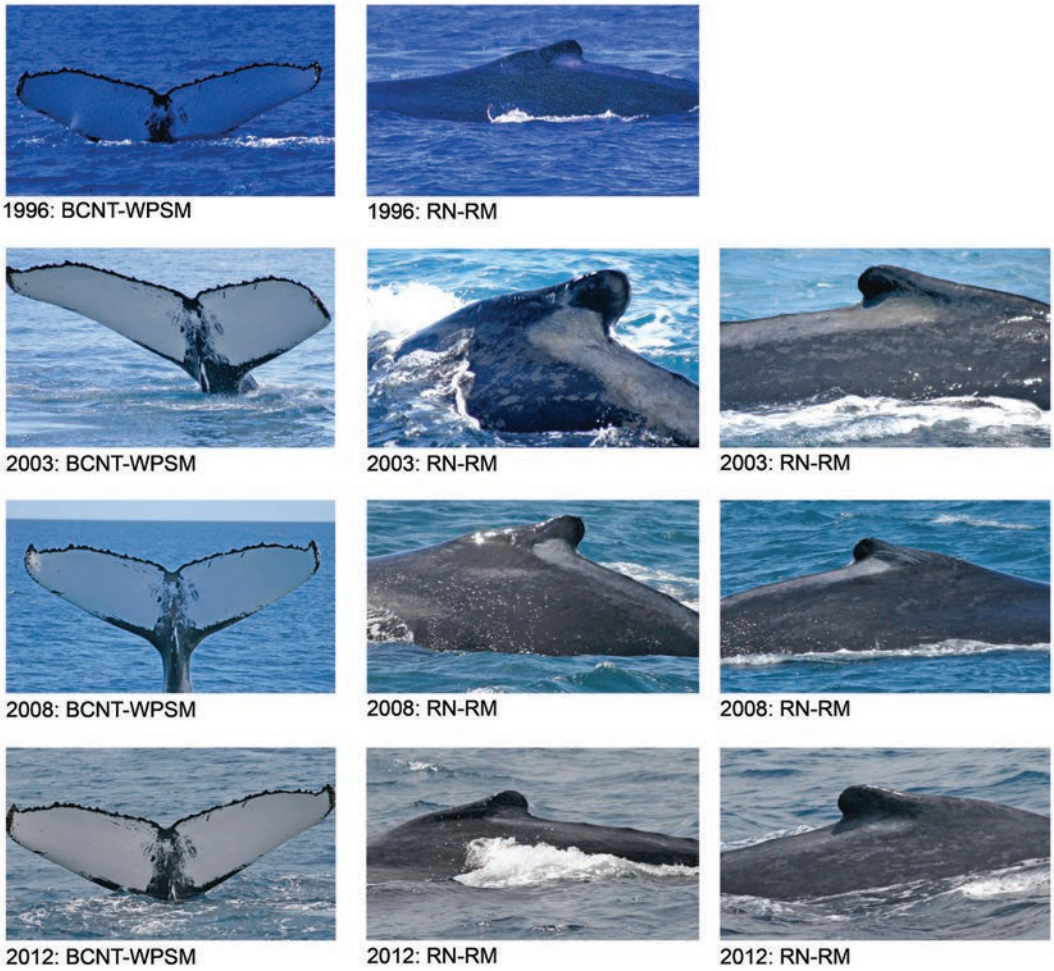

Hooked, peduncle knobs - HK PK


Flat top, scratch marks - FT SM

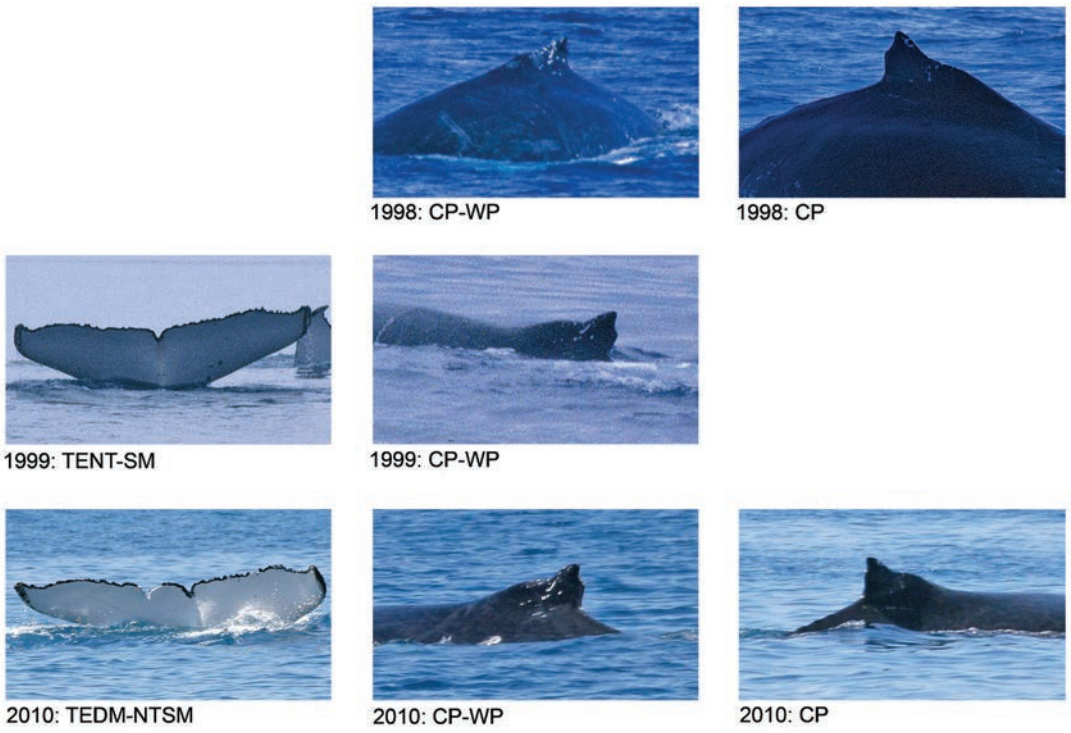
Supplementary Material Fig. 2. A selection of 16 dorsal fin/lateral body photographs illustrating dorsal-fin shapes and lateral body marks and related ACDC codes (see Table 2).



Supplementary Material Fig. 3. Whale UID 0006 [White Wolf] (Resighting history see Table 6b in main text): Photography of ventral-tail fluke, left and right dorsal fin and lateral body marks (top to bottom) in 1994, 1997, 2007 and 2012. The ACDC categorisation of this ventral-tail fluke is TENT (Trailing Edge and Notch, see Table 4 in main text and Supplementary Material Fig. 1). A total of 63.5% of the ventral-tail flukes in the Hervey Bay catalogue (1790 of 2821, 63.5%; see Table 4 in main text) exhibit these characteristics. Hence in a large ACDC category such as TENT, the use of dorsal fin shape and lateral body marks provide valuable additional identification information to minimise and manage potential mis-identification. Notice the fresh tertiary rub mark on dorsal fin images in both 2007 and 2012. Appliance of the strict ACDC viewing protocol for ventral-tail flukes, dorsal fin shapes and lateral body marks aids individual identification while tertiary marks do not interfere with individual identification.



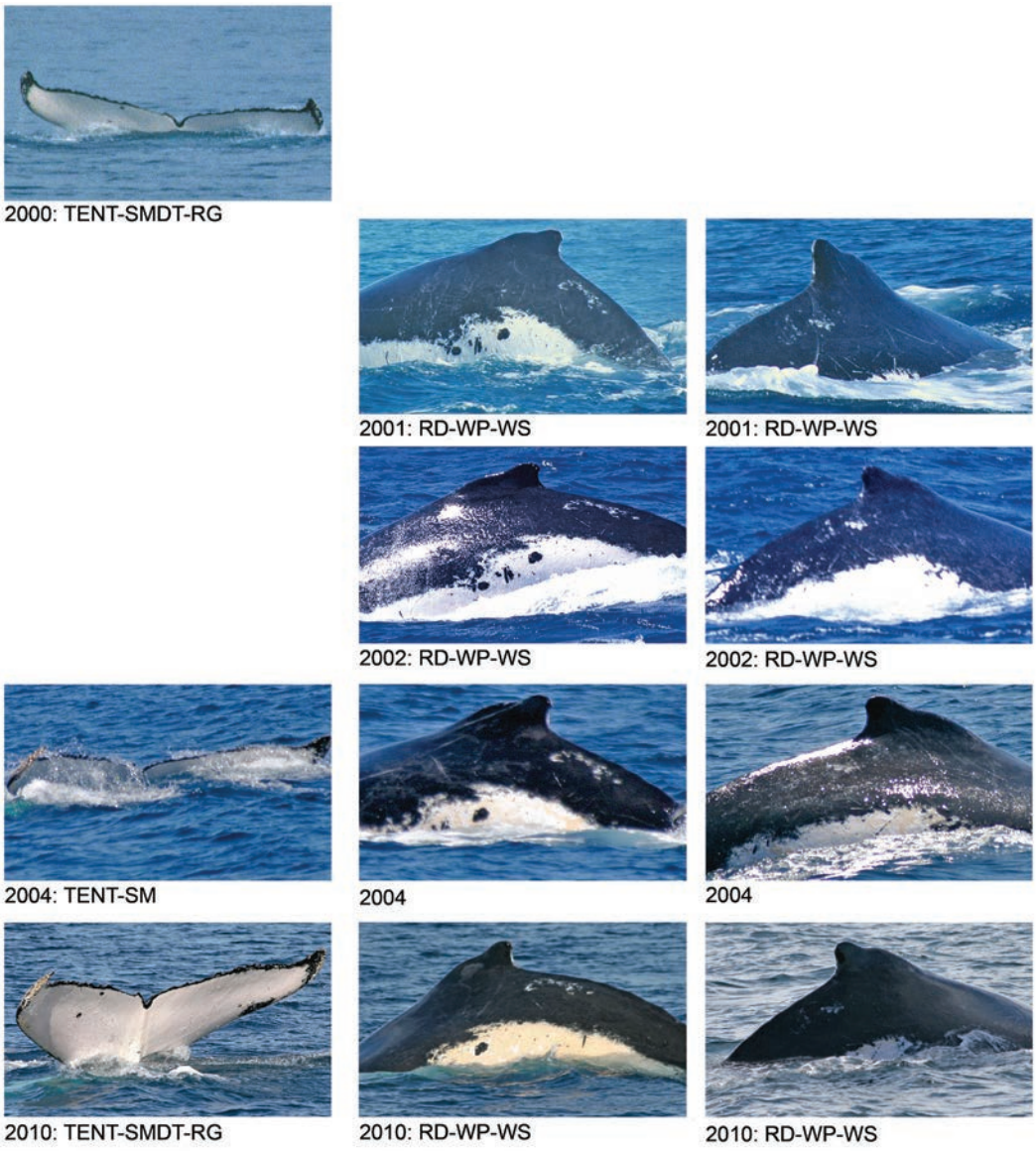
Supplementary Material Fig. 4. Whale UID 0007 [Nala] (Resighting history see Table 6a in main text): Photography of ventral-tail fluke, left and right dorsal fin shape and lateral body marks (top to bottom) in 1996, 2003, 2008 and 2012. While there is no change in the ventral-tail fluke marks and ACDC categories over time, use of the dorsal fin shape provides confirmation of individual identity. Note variation in tertiary grey spine mark over years, associated with the presence of a calf, and although of interest such tertiary marks do not influence individual identification.



Supplementary Material Fig. 5. Whale UID 0300 [Hockey Stick] (Resighting history see Table 7 in main text): Photography of ventral-tail fluke, left and right dorsal fin shape and lateral body marks (top to bottom) in 1998, 1999 and 2010. Damage to the primary trailing edge is clearly evident in 2010. This sequence illustrates how close inspection of the high-resolution photography of the undamaged trailing edge together with the primary dorsal fin shape and secondary lateral body marks provides confirmation that the fluke is of the same individual whale. Note that in 1998 identification was only by dorsal fin shape and lateral body marks.

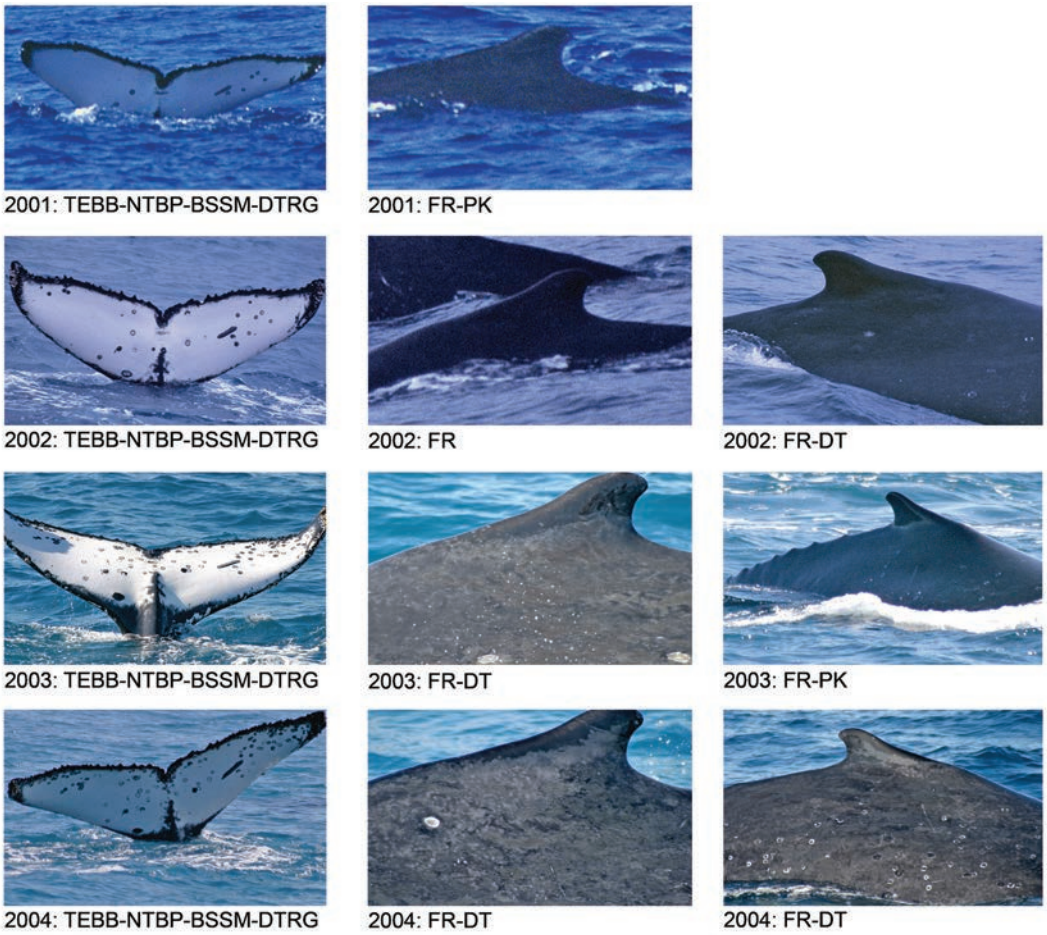
Supplementary Material Fig. 6. Whale UID 0715 [Peru] (Resighting history see Table 7 in main text): Photography of ventral-tail fluke, left and right dorsal fin shape and lateral body marks (top to bottom) in 2001, 2004 and 2009. Minor damage is evident to the left side of the trailing edge of the ventral-tail fluke in 2009. While changes occurred in the primary ACDC characteristics of the ventral-tail fluke the primary dorsal fin shape is constant throughout the years. Changes in tertiary lateral body marks (clearly observable with high-resolution photography) are consistent with the observed changes in horizontal and vertical surface scratch marks observed in 75% of males (see Table 7 in main text). In spite of the changes, identification can be maintained over years using the strict ACDC viewing protocols for ventral-tail fluke and primary dorsal fin shape and secondary lateral body marks. The changes in tertiary marks do not interfere with individual identification.

Supplementary Material Fig. 7. Whale UID 0586 [Moon Shark]: (Resighting history see Table 7 in main text): Photography of ventral-tail fluke, left and right dorsal fin shape and lateral body marks (top to bottom) in 2001, 2007, 2008. Changes in tertiary marks on the ventral-tail fluke are evident but there was no change to the primary trailing edge and notch, which provided continuity of identification over years. In 2007 there was damage to the top of the dorsal fin and extensive changes in lateral body marks consistent with Moon Shark being a male. The dorsal shape remained consistent over years.



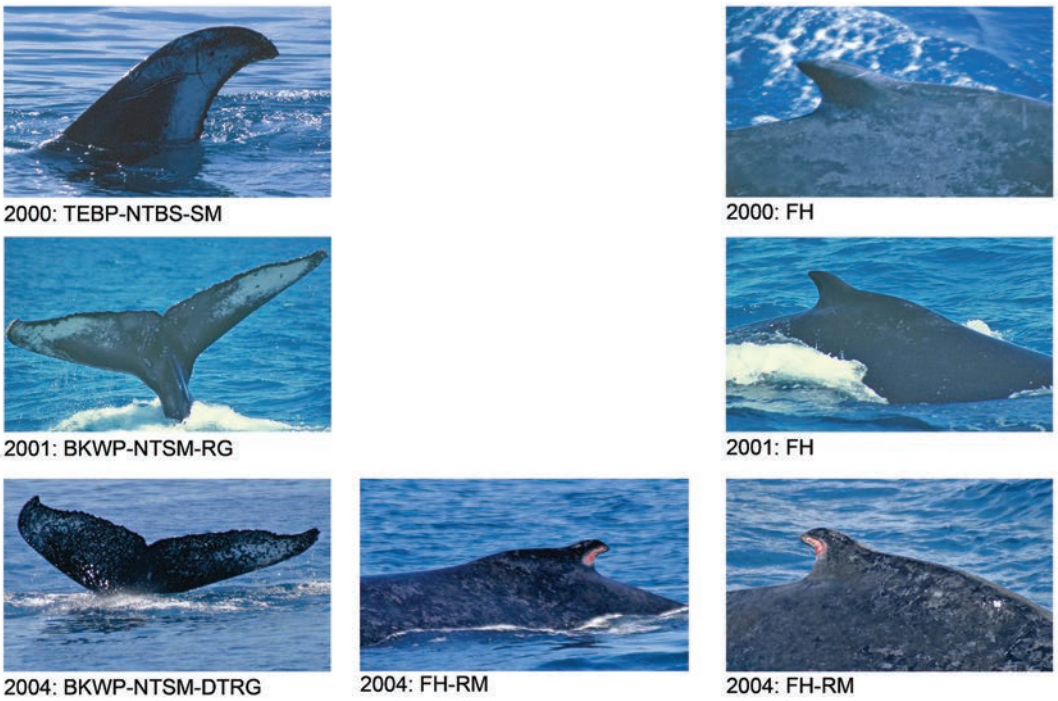
Supplementary Material Fig. 8. Whale UID 0730 [Scorpio]: (Resighting history see Table 7 in main text): Photography of ventral-tail fluke, left and right dorsal fin shape and lateral body marks (top to bottom) in 2000, 2001, 2002, 2004, 2010. Minor changes were observed in the primary trailing edge of the ventral-tail fluke. The primary dorsal fin shape and secondary lateral body marks were consistent over years. Note the small white patch just below both sides of the dorsal fin visible in each year. Sequential photography was used to match the ventral-tail fluke, dorsal fin shape and lateral body marks as being from the same individual. The two tertiary dots on the mid-right hand side of the ventral-tail fluke are evident in 2000 and 2010. Combined use of ventral-tail fluke, dorsal fin shape and lateral body marks, supported observations and identification over years. Note that in 2001 and 2002 identification was only by dorsal fin shape and lateral body marks.

Supplementary Material Fig. 9. Whale UID 0161 [Floppy]: (Resighting history see Table 7 in main text): Photography of ventral-tail fluke, left and right dorsal fin shape and lateral body marks (top to bottom) in 1996 (calf), 1997 (yearling), 2001, 2003, 2006, and 2007. There are no changes to the ventral-tail fluke, which is identifiable over years by the trailing edge and notch. The dorsal fin shape is constant but there is a natural evolution of the dorsal fin marks from a calf to 5 years and they are stable from 5 years onwards. Note that in 1996 and 2007 identification was only by dorsal fin shape and marks.

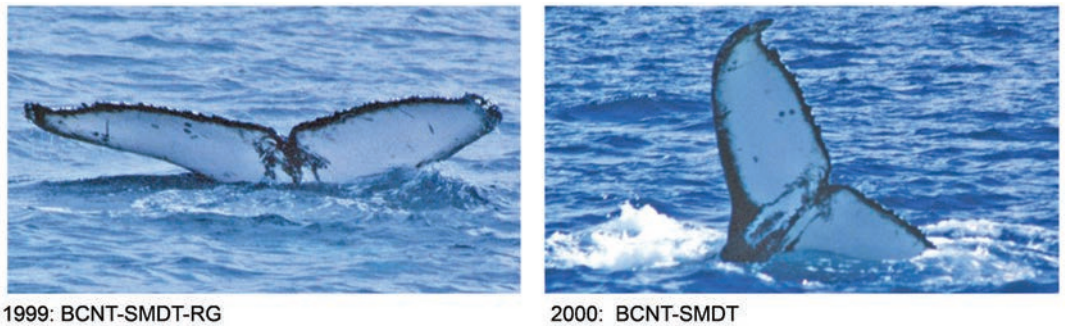


Supplementary Material Fig. 10. Whale UID 0966 [Atoll] (Resighting history see Table 8 in main text): Photography of ventral-tail fluke, left and right dorsal fin shape and lateral body marks (top to bottom) in 2001, 2002, 2003 and 2004. Increased tertiary dots are evident over the years with no change in the shape of the primary trailing edge and a horizontal tertiary scratch mark in the middle of the right side of the ventral-tail fluke over years. Dorsal fin shape is consistent over years.

Supplementary Material Fig. 11. Whale UID 1046 [Ninety Nine]: (Resighting history see Table 8 in main text): Photography of ventral-tail fluke, left and right dorsal fin shape and lateral body marks (top to bottom) in 2002, 2004, 2010. Similar to whale UID 0524 [Ziggy] (see Supplementary Material Fig. 12), the primary black center and the secondary black patch have faded markedly over the early years of this whale. Whilst the primary dorsal fin shape is constant over years there are evident changes in the secondary lateral body marks, especially long scratches consistent with those observed in 75% of males. Note the two raised tertiary peduncle knobs, which can be observed in left and right body photographs over the three years. This illustrates that although changes occurred in the ventral-tail fluke and lateral body the combined use of ventral-tail fluke marks together with dorsal fin shape and peduncle knobs aided consistent identification over years.



Supplementary Material Fig. 12. Whale UID 0665 [Moon E.T.] (Resighting history see Table 8 in main text): Photography of ventral-tail fluke, left and right dorsal fin shape and lateral body marks (top to bottom) in 2000, 2001 and 2004. Significant changes are evident in the proportion of secondary white to black pigmentation and in the primary black centre of the ventral-tail fluke. Nevertheless, the right hand primary dorsal fin shape is consistent over years allowing confirmation of identity over time in spite of significant changes to the ventral-tail fluke marks. There is a consistent tertiary scratch mark on the left hand side of the ventral-tail fluke, clearly evident when viewed in high-resolution photography. A new tertiary rub mark on the rear of the dorsal fin is evident in 2004 when a calf was present.



Supplementary Material Fig. 13. Whale UID 0524 [Ziggy]: (Resighting history see Table 8 in main text): Photography of ventral-tail fluke in 1999 and 2000. There were no changes in the trailing edge providing confirmation of identification between the two years. The primary black center and secondary black stem patch in the center of the ventral-tail fluke exhibit marked fading, while two tertiary dots on the upper mid-left of ventral-tail fluke are constant. As with all the immature to mature whales in the sample, there are several changes evident in tertiary scratch marks and dots on the ventral-tail fluke.