OBSERVATIONS OF A HYPO-PIGMENTED HUMPBACK WHALE, *MEGAPTERA NOVAEANGLIAE*, OFF EAST COAST AUSTRALIA: 1991- 2000

PAUL H. FORESTELL, DAVID A. PATON, PAUL HODDA AND GREGORY D. KAUFMAN

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In 1991 an apparently all-white humpback whale was observed and photographed from a shore-based observation platform in Byron Bay, NSW, Australia. The following year, the same animal (based on comparison of photographs of dorsal fin shape) was observed and extensively photographed in Hervey Bay, Queensland. Since then, more than 50 reports of white whale sightings have been obtained with reports in every year except 1997. The whale appears to be an albino and is the only documented occurrence of an all-white humpback whale. Sightings of this unusual animal provide important information on the migratory characteristics of humpback whales along the east coast of Australia. We investigated all known reports of a white whale from 1991-2000 and applied a scale of verifiability to each report. We plotted the location and time of each reliable sighting and summarised the range, rate of movement, social patterns and annual changes in migratory characteristics based on these reports. We present evidence that the white whale is now an adult male and relate its movements to what is known about male humpback whales from other studies. ❐ *Humpback whale, hypo-pigmented, white whale, Australia.*

Paul H. Forestell, Southampton College, Southampton, NY, USA, 11968, and Pacific Whale Foundation, 101 N. Kihei Rd., Kihei, HI, USA, 96753; David A. Paton, Southern Cross Centre for Whale Research, PO Box 157, Lismore 2480 Australia; Paul Hodda, Australian Whale Conservation Society, 8 Flemington Close, Capalaba 4157, Australia; Gregory D. Kaufman, Pacific Whale Foundation, 101 N. Kihei Rd., Kihei, HI, USA. 96753; 30 April, 2001.

On 28 June, 1991 a humpback whale, *Megaptera novaeangliae*, exhibiting an unusual amount of white colouration was photographed near Byron Bay, NSW (Hodda, 1991) (Fig. 1). That was the only reported sighting of the uniquely marked whale that year. Subsequently, the presence of an apparently all-white humpback whale was reported at various locations along the east coast of Australia. We present a summary of sightings since 1991 and discuss the behaviour and significance of this unusual animal.

Humpback whales are regularly observed travelling along the east coast of Australia from June to November each year (Paterson & Paterson, 1989). Southern Hemisphere humpback whale stocks were reduced to <10% of pre-exploitation levels by commercial whalers between 1930-1960 (Allen, 1980). East Australian humpback whales were severely depleted by shore whaling stations at Tangalooma and Byron Bay operating between 1952-1962 (Paterson & Paterson, 1989; Paterson, 1991; Orams & Forestell, 1995). Chittleborough (1965) estimated population levels had dropped to <5% of pre-exploitation numbers when the International Whaling Commission in 1963 extended complete protection to Southern Hemisphere humpback whales. Since then, studies conducted off the east coast of Australia have given evidence of recovery (Bryden et al., 1990; Paterson et al., 1994, 2001; Chaloupka et al., 1999). Bryden et al. (1990) and Paterson et al. (1994, 2001) have independently estimated the rate of recovery to be in excess of 10% per annum, based on annual counts from shore stations and aerial surveys over a 20 year period, during the annual migrations past North Stradbroke Island, Queensland. Chaloupka et al. (1999), analysed 10 years of re-sight histories of photographically-identified humpback whales in Hervey Bay, Qld, and concluded the east Australian Group V stock of humpback whales increased at a mean rate of 6.3% between 1988-1996.

Based on analysis of the recovery of marking darts (Dawbin, 1966), and reinforced by photographic documentation of the movement of one individually identified whale (Kaufman et al., 1990), it is generally believed east coast Australia humpback whales spend the austral summer feeding in Antarctic Area V (130°E-170°W). There, enormous supplies of the euphasiids upon which they feed allow them to store sufficient food reserves to last for most of the migration to and from lower latitudes, where

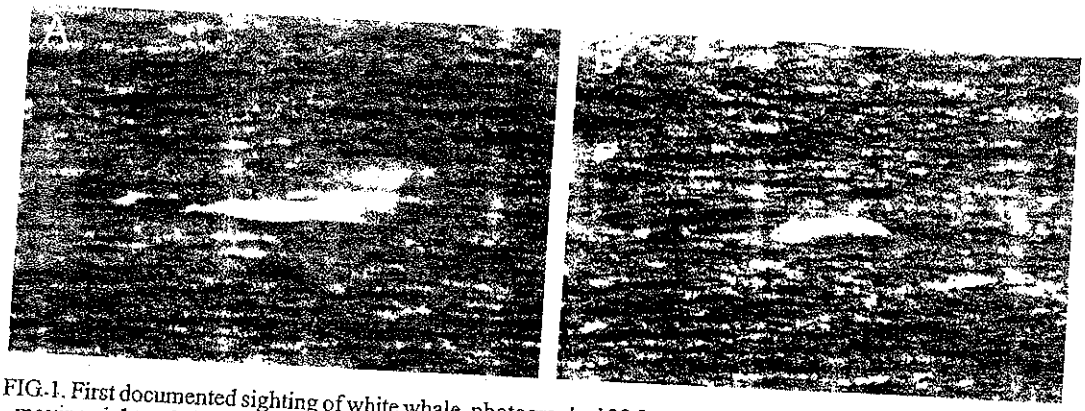

FIG.1. First documented sighting of white whale, photographed 28 June, 1991 off Byron Bay, NSW. The whale is moving right to left, A, with remnants of the 'blow' seen near the dorsal fin; B, diving.

it is generally believed they do not regularly feed (Dawbin, 1956). Although humpback whales are found widely distributed throughout the Western South Pacific (Dawbin, 1964) the patterns of exchange between known wintering areas are still unclear. Garrigue et al. (2000) provide a summary of resights between east Australia, New Caledonia and New Zealand, and Baker (pers. comm.) has reported a match between east Australia and Tonga.

Analysis of repeated sightings of uniquely marked animals is an established method for obtaining information about population size, movement, group structure, site fidelity, reproductive rates and other life history patterns (Hain & Leatherwood, 1982; Würsig & Jefferson, 1990). Humpback whales are ideally suited to such studies, as they can be individually identified by variation in natural markings on the ventral surface of their tail flukes (Katona et al., 1979) and additionally by lateral body markings, particular in Southern Hemisphere stocks (Kaufman et al., 1987; Gill & Burton, 1995).

Confirmation of repeated sightings of identified humpback whales depends first upon obtaining high-quality photographs of the flukes and lateral body markings of animals and then careful documentation and comparison to ensure reliable determination of resight patterns (Hammond, 1990; Kaufman et al., 1993). Such efforts have been limited to a small number of skilled observers. Repeated sighting of an all white humpback whale since 1991 provided a further opportunity to study migratory patterns of Group V humpback whales as such a uniquely marked animal would be expected to have a high probability of being observed and identified by a wide range of observers.

Analysis of sightings of identified animals could clarify the extent of coast along which individual humpback whales may be observed during migration (Stone et al., 1990); minimum estimated rates of movement over long distances (Gabrielle et al., 1996); residency patterns in areas of known aggregation (Cerchio, 1998); and year-to-year differences in migratory timing (Baker et al., 1986; Krutzikowsky et al., 1991; Clapham et al., 1993). Additional information about social behaviours might be determined from data on pod size and composition and observations of behavioural displays of particular identified animals (Tyack & Whitehead, 1983). While recognising limits on the ability to generalise from the behaviour of one animal to the population as a whole, one might still uncover important information by tracking observations of uniquely-identified individuals over extended periods of time and space (Hain & Leatherwood, 1982). To our knowledge, the sighting history of the white whale described in this report constitutes the most detailed and long-term case study of a humpback whale's movement patterns.

METHODS

DATA-BASE. A database of observations of a hypo-pigmented whale was developed to assess the reliability of the sightings; establish the range of times and locations over which the reports were made; examine behavioural details which might help determine the age and sex of the observed whale(s); and determine whether they were all of the same whale.

Reports of sightings of all-white humpback whales were identified through searches of newspapers, contacts with television stations and

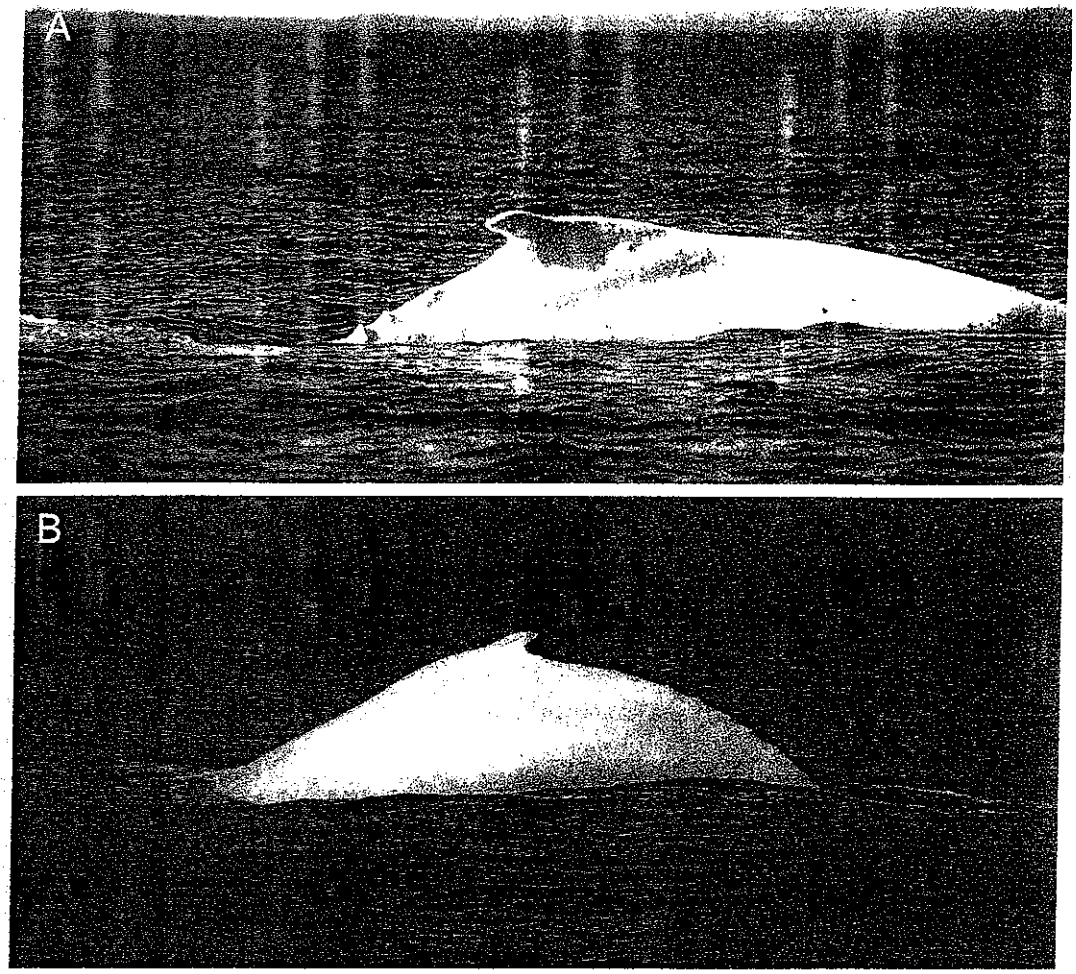

FIG. 2. A, right side of dorsal area, photographed 13 September, 1992 in Hervey Bay, Qld. B, left side of dorsal area, photographed 20 June, 2000 near Port Stephens, NSW.

interviews with researchers, government agencies and commercial boat operators. A difficulty of creating a database of reported observations obtained by a wide cross-section of the public is to verify the accuracy of reports. While anecdotal reports have been found useful in drawing conclusions about the status and behaviour of Group V humpback whales (Paterson & Paterson, 1984; Simmons & Marsh, 1986), it is probable that not all anecdotal reports are of equal reliability, and in the present case we attempted to differentiate between types of report. Reports were categorised as: 'Certain'- observations documented with movie, video, or still images; 'Likely'- first-hand accounts by those qualified through training and experience to be considered experts in identification and observation of humpback whales (including field-based marine resource management agents, operators of commercial whale watch vessels, marine mammal scientists and laypersons specifically trained in observation of humpback whales); and 'Anecdotal'- all other reports.

For the purposes of our analysis, all Certain and Likely reports were considered reliable, while Anecdotal reports were excluded.

ANALYSIS. Once all reports were gathered and assessed, we compared photographs and videos across years to determine whether these sightings

were of the same animal. We then plotted the location of each reliable (Certain or Likely) sighting and determined the range and rate of movement for each year in which sufficient numbers of reports were obtained. We also assessed the information provided with each report to determine the nature of social behaviours exhibited by the whale, and hence its likely gender.

RESULTS

Over 50 reports were gathered. When more than one report of a sighting was obtained at or near the same time (i.e., on the same day) only one report of the most reliable category was included. A summary of 35 unique sightings is summarised in Table 1 (Information on individual reports is provided in the Appendix). Twelve of the 35 observations were documented either by video or film, while an additional 13 were considered to be reliable reports by experts. Of the 10 sightings judged to be anecdotal, 4 occurred within one day of separate sightings of higher reliability in the same vicinity and the remaining 6 were without any corroborative support.

COMPARISON OF IMAGES. The sighting data indicate that only one all-white humpback whale has been observed off east Australia. Analysis of video and photographs from the 12 documented sightings of a white whale indicated the same animal was observed in each case. The whale has a distinctly curved dorsal fin, which is evident in each of the sightings (e.g., Fig. 2A shows the white whale observed in Hervey Bay, Qld on 13 September 1992; Fig. 2B in Port Stephens, NSW on 20 June, 2000). It is not possible to confirm whether the 13 'Likely' reports are of the same whale, since they are not supported by photographic evidence, however the sightings fit well within the patterns established by the 12 observations which were supported. These reports were generally consistent with what is known about migration of humpback whales along the east Australian coastline and occur in locations near the photographically documented sightings.

Photographs taken of the white whale have shown it as close as 20m at the surface and at ~150m from an aeroplane (Fig. 3). The entire dorsal surface of the whale is white, including the pectoral and tail fins. The whale has also been videotaped while breaching at a distance of ~100m. Observers reported viewing the ventral surface almost to the tail and, except for a clump of barnacles attached to the ventral pleats, that surface was also completely white. The whale's tail flukes have been photographed and are completely white on both the ventral and dorsal surface (Fig. 4A, B). It appears the whale's skin is uniformly white over its entire body. It is also clear that the whiteness is due to natural colouration of the whale, rather than an artifact created by one of a variety of identified dermatoses due to bacteria, fungi, or ectoparasites (Migaki, 1987).

TABLE 1. Summary of observations of white whale for each sighting category within each year. * In 1992 and 1993 a white whale was photographed by scores of individuals during the time (less than two full days) it was observed in the vicinity of Hervey Bay. However, only one 'Certain' report was included for each day on which the whale was photographed.

Year	Observ-ations	Category	Days Observed	Places Observed
1991	1	Certain	1	1
	0	Likely	0	0
	0	Anecdotal	-	-
1992*	4	Certain	4	2
	5	Likely	5	5
	4	Anecdotal	-	-
1993*	2	Certain	2	2
	2	Likely	2	2
	3	Anecdotal	-	-
1994	1	Certain	1	1
	1	Likely	1	1
	2	Anecdotal	-	-
1995	2	Certain	2	2
	0	Likely	0	0
	1	Anecdotal	-	-
1996	0	Certain	0	0
	1	Likely	1	1
	0	Anecdotal	-	-
1997	0	Certain	0	0
	0	Likely	0	0
	0	Anecdotal	-	-
1998	1	Certain	1	1
	1	Likely	1	1
	0	Anecdotal	-	-
1999	0	Certain	0	0
	3	Likely	3	3
	0	Anecdotal	-	-
2000	1	Certain	1	1
	0	Likely	0	0
	0	Anecdotal	-	-
Totals	35		25	23

The most recent photograph (Fig. 2B) shows considerable yellow colouration along the whale's flanks. This is most probably due to the presence of an Antarctic diatom *Cocconeis ceticola*, which adheres to white areas of a humpback whale's body in a film-like covering (Burton, 1991). Bannister (1977) has suggested such colouration may indicate a whale which has recently moved from colder waters, which is consistent with the fact that the photograph was taken on 20 June, considered to be early in the northward migration (Dawbin, 1966).

EXTENT AND RATE OF MOVEMENT. Geographic locations of the 35 sightings of a white whale reported along the east Australian coast between 1991-2000 are shown in Fig. 5. The 25 reliable sightings clump into discrete areas: the Whitsundays Islands, Fraser Island, offshore Brisbane, Byron Bay, Port Stephens (just north of Sydney) and in the vicinity of Gabo Island near the NSW/Victoria border. This may reflect the high incidence of human activity in these areas, including both recreational tourism and commercial fishing, which increases the probability that the whale was observed when present. Another possibility is that the whale may have spent more time in some or all of these areas; or a combination of both possibilities may be at work.

The year 1992 was unusual in that 9 reliable sightings were obtained compared with 3 or fewer in other years. Using 1992 sighting data the whale's movement along the east Australia coast during the northward and southward migrations was plotted (Fig. 6), assuming a direct transit between known locations. The whale was first observed near Snowy River, Victoria, on the 9th of June — the next day it had moved ~100km east. Its most northerly reported location was in the Whitsundays on the 12th of August — a distance of ~2,345km in 64 days, (an average of 1.5km/hr, or 37km/day). The whale was also observed in the Whitsundays on the 13th of August. One month later (13th September) it was seen in Hervey Bay. Although next observed in Moreton Bay, the exact day is not certain. The last reliable sighting that year was near Eden, NSW on the 8th of October, a move of 2,153km from the Whitsundays in 59 days (1.5km/hr, or 36.5km/day). The final sighting of 1992 was approximately 200km from the first sighting 4 months earlier. The calculated rate of movement southward in 1992 was virtually identical to the northward movement (1.5km/hr).

The rate of migratory movement in 1992 was considerably slower than other estimates of humpback whale movements. Dawbin (1966) estimated migratory rate for humpback whales at 2.9km/hr over the duration of migration north and south, based on changes in the timing of peak catches at coastal whaling stations. Kaufman & Osmond (1987) reported short-term speeds of 8.7km/hr, based on theodolite observations of whales passing a headland on North Stradbroke Island (Moreton Bay, Qld). Using resights of photographically-identified individuals moving over more extended distances (e.g., between North Stradbroke Island and the Whitsunday Islands), Kaufman & Osmond (1987) estimated mean speed of migratory movement to be 3.1km/hr. Chittleborough (1953) noted that whales observed during aerial surveys along the coast of Western Australia averaged 8km/hr and ranging from 5-14km/hr. In Hawaii, Bauer (1986; cited in Gabriele et al., 1996) found that whales tracked with theodolite averaged 4.4km/hr, with a maximum of just over 11km/hr. Baker et al. (1985) used resights of 5 photographically-identified individuals to estimate an average of 1.9km/hr between Hawaii and Alaska, a rate more consistent with that shown by the white whale. In contrast, Gabrielle et al. (1996) reported a humpback whale photo-identified in southeast Alaska and 39 days later in Hawaii, requiring an average of 4.7km/h.

From these studies, variations in estimated rates of movement appear to reflect differences in scale. Observations of animals over extended distances have generally led to lower estimates than observations over short distances. Estimates based on photographic resights of animals more than two days apart may underestimate actual rate if it is not certain the whale was observed on its last day in one location or its first day in the next. Differences may also reflect significant changes in behavior at different points in the migration.

Brown & Corkeron (1995) argued that the migratory movement of humpback whales along the coast of Australia may be characterised by a behavioural continuum associated primarily with variations in breeding behaviour — including prospecting for mates, competition between males and possible mate-guarding. There is evidence of humpback whales engaged in feeding during the latter part of the migratory period, in the vicinity of Eden, NSW (Kaufman & Naessig, unpubl. data). Mate (1999) provided evidence that humpback whales, satellite-tagged

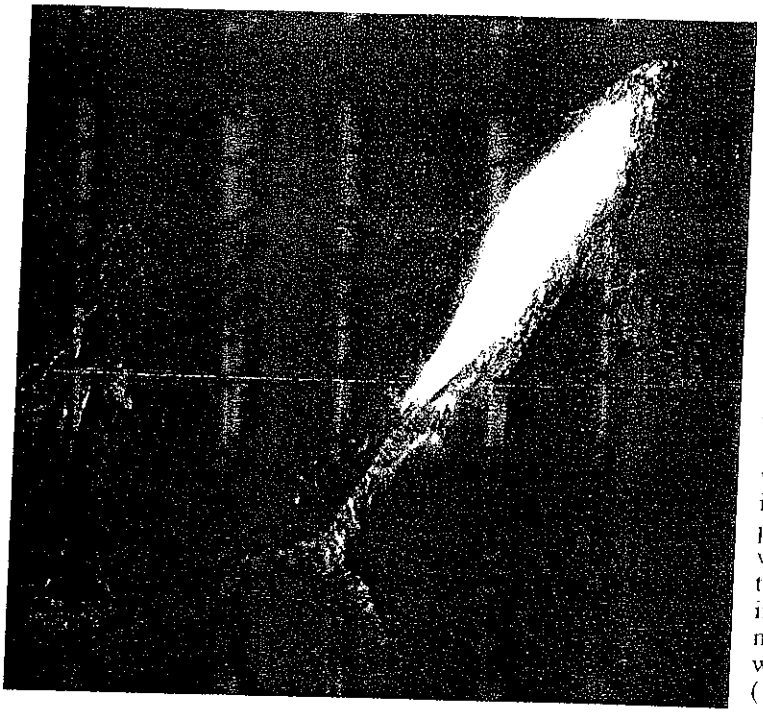

FIG. 3. Aerial view of white whale, accompanied by normally-coloured humpback whale, 14 September, 1992 near Hervey Bay.

in Hawaii, demonstrated highly variable individual patterns of movement at each stage of their annual cycle. Such patterns may be expected to result in a considerable variation in rates of movements within extended periods. A more detailed consideration of the white whale's movement reinforces such an expectation. Table 2 provides a breakdown of contiguous sightings of the white whale since it was first observed in 1991. Each entry reports the two successive locations at which the whale was observed; whether the observation was during the northward or southward migration, or at the assumed terminus in the Whitsunday Islands; the year of the observation; the shortest straight-line distance between sightings; the number of days between sightings; and the calculated rate of movement. Rates range from a low of 0.38k/hr to a high of 6.33km/hr.

Overall, data on rate of the white whale's movement indicate a highly variable pattern, most likely associated with a range of activities over the ~4-month period travelling along the coast. These movements are consistent with Brown & Corkeron's (1995) conclusion 'that the migration of humpback whales is more than just a swim, and that the social influences on this species' migratory behaviour are subtle and complex'.

No observations of white whales were reported prior to 1991, or during 1997. Hodda (1991) noted that the white whale 'was too large to be a juvenile', although 'it did not appear to be fully grown', suggesting the whale was already between 3-5 years of age. The fact that the white whale was not observed as a calf or yearling prior to 1991, or during 1997 is of some interest, given its high visibility and the attention humpback

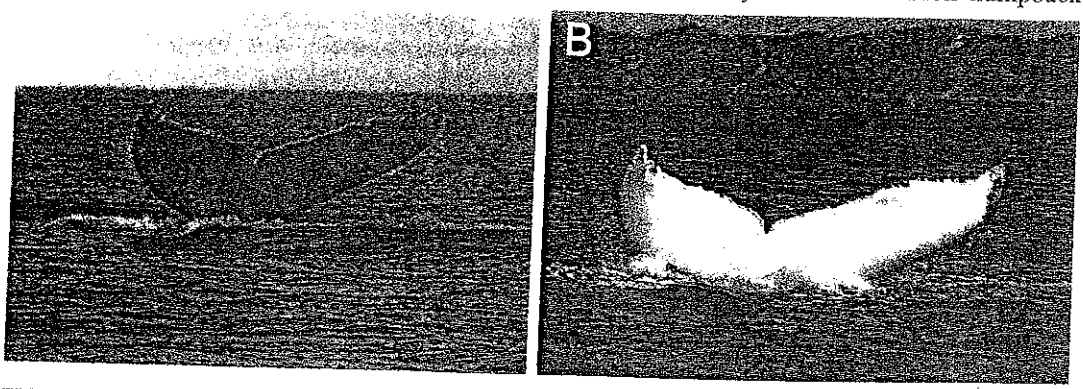

FIG. 4. Tail fluke; A, ventral surface; B, dorsal surface.

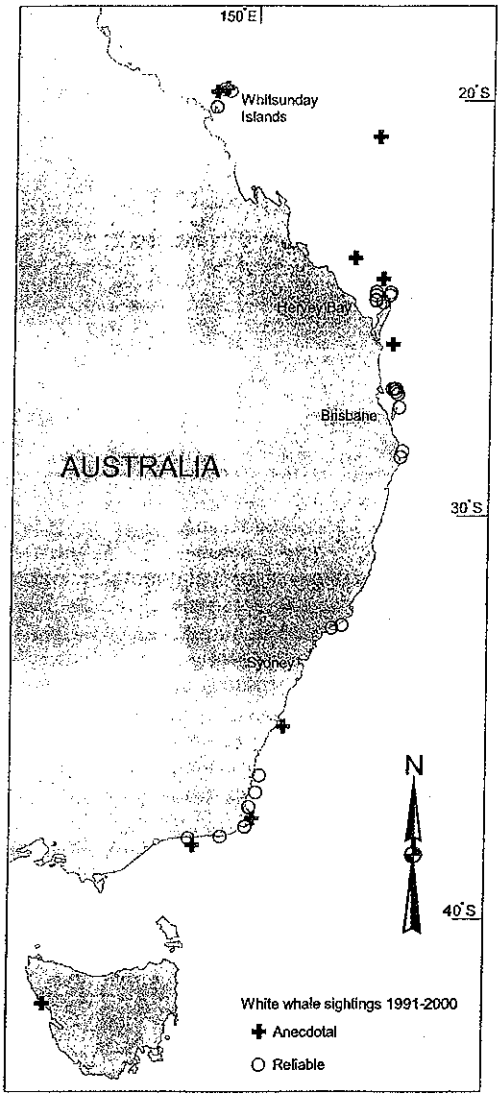

FIG. 5. Locations of reliable and anecdotal sightings of white whale from all reports from 1991-2000.

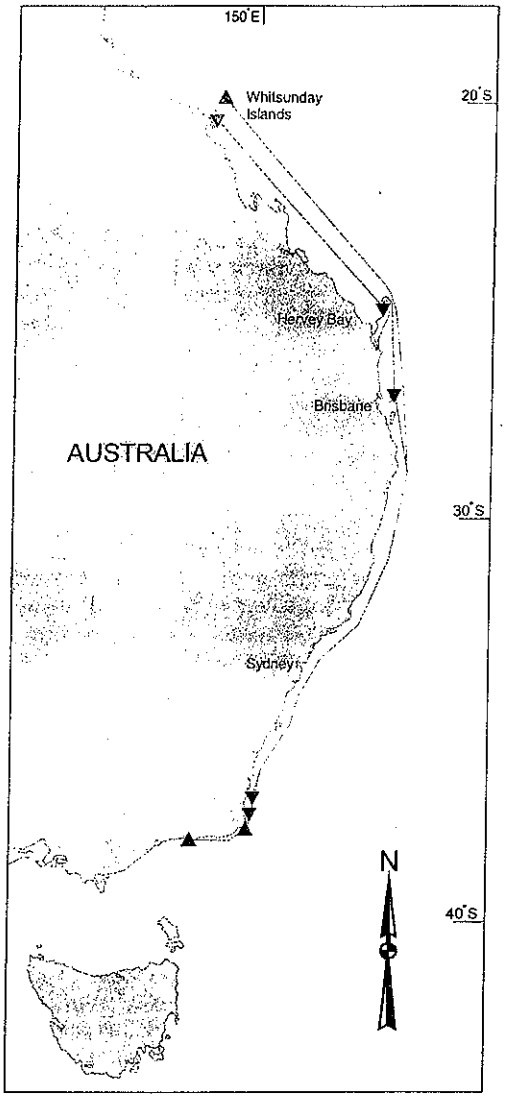

FIG. 6. Locations of reliable sightings: ▲, during northward migration, June – August, 1992; ▼, during southward migration, August – October, 1992.

whales receive while migrating along the Australia coast. Movement of identified humpback whales between known wintering aggregations of the Southern Hemisphere has yet to be described in detail (Garrigue et al., 2000) and it is possible that in some years the white whale may have spent winter at a location other than east Australia.

BEHAVIOURAL OBSERVATIONS. The white whale is now at least 11 years old and based on an initial estimate of the animal's size and age (Hodda, 1991) it may now be 12-15 years of age. Its behaviour over time has indicated it is a male, and perhaps a male that has recently reached reproductive maturity. In 1993 it was observed escorting a mother/calf pod — an indicator the animal is a male (Clapham, 2000). In 1998 during its visit to Hervey Bay it was heard singing (W. & T. Franklin, and M. Osmond, pers. comm.) — a more reliable indicator that it is a male (Glockner, 1983; Baker & Herman, 1984). In cases where pod size has been reliably reported, the white whale has been observed in pods of 2 in 40%,

TABLE 2. Distance and rate of movement between each set of contiguous reliable observations from 1991-2000.

Location	Direction	Dates	Year	Dist (Km)	Days	Km/hr
Snowy R. – Gabo I.	N	9 Jun – 10 Jun	1992	138	1	5.75
Byron Bay – Hervey Bay	N	16 Jul – 22 Jul	1995	422	6	2.0
Eden – Whitsundays	N	10 Jun – 12 Aug	1992	2207	63	1.46
Whitsunday Islands	N/A	12 Aug – 13 Aug	1992	15	1	0.63
Hervey Bay	S	13 Sep – 14 Sep	1992	10	1	0.42
Hervey Bay	S	29 Aug – 30 Aug	1993	15	1	0.63
Brisbane	S	1 Oct – 2 Oct	1999	43	1	1.79
Montague I. – Cape Everard	S	14 Oct – 15 Oct	1993	152	1	6.33
Tathra – Eden	S	6 Oct – 8 Oct	1992	42	2	0.88
Hervey Bay – Eden	S	14 Sep – 6 Oct	1992	1430	22	2.71
Hervey Bay – Brisbane	S	30 Aug – 29 Sep	1993	318	30	0.44
Whitsundays – Hervey Bay	S	13 Aug – 13 Sep	1992	674	31	0.91
Whitsundays – Hervey Bay	S	20 Jul – 2 Oct	1998	670	74	0.38

alone in 25% and with large surface active groups in 17%, including its most recent sighting near Port Stephens just north of Sydney in June 2000 (F. Future & S. Allen, pers. comm.). These observations are consistent with knowledge of migratory behaviour of adult male humpback whales (Dawbin, 1966; Clapham, 1994; Brown & Corkeron, 1995).

DISCUSSION

UNIQUENESS OF OBSERVATION. To our knowledge, this is the first and only documented occurrence of a totally white humpback whale. Hain & Leatherwood (1982) and Fertl et al. (1999) summarised known accounts of anomalously white cetaceans listing no observations of humpback whales among the 22 species reported to have demonstrated albinism. Anecdotal accounts of white humpback whales exist (Baker, 1984; Weinrich, pers. comm.; Sharpe, pers. comm.) and recently a report was widely circulated of a 'mostly white' humpback whale in Niue, a small island nation in the South Pacific, east of Tonga and south of Samoa (Crowder, pers. comm.). However, such accounts generally suggest the animals were partly, rather than completely white. A disease known as Chediak-Higashi syndrome, which results in a 'bleaching' of normal skin colouration, has been reported in marine mammals (Matkin & Leatherwood, 1986). In such cases, however, some degree of shading is visible and is readily differentiated from true albinism on closer inspection.

We have observed whales in Hervey Bay that have been covered by barnacle scars or a white fungus-like covering that, from a distance, gave the whale an appearance of primarily white with dark mottling. Group V whales are also known to have considerably less dark pigmentation overall than whales elsewhere (Kaufman et al., 1987). Northern Hemisphere humpback whales are generally quite dark overall, with perhaps 30% showing extensive white on the pectoral flipper and ventral fluke surfaces (Forestell, 1989; c.f. Fig. 7). Southern Hemisphere humpback whales demonstrate at least four types of colouration, with Type 1 showing the greatest extent of white (Fig. 8). Kaufman et al. (1993) found that ~20% of whales photo-identified off east Australia are Type 1 and another 20% are Type 2. It would not be unusual for lay observers to report an animal primarily observed from the ventral aspect, either above or below the surface, as a white whale, particularly if the observation is either brief or on only one occasion.

IS THE WHITE WHALE AN ALBINO? Whether the subject whale is a 'true' albino is

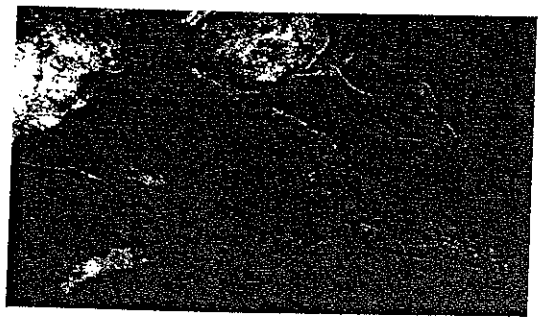

FIG. 7. Aerial view of mother, calf and escort humpback whale in Hawaii, showing colouration pattern typical of Northern Hemisphere animals.

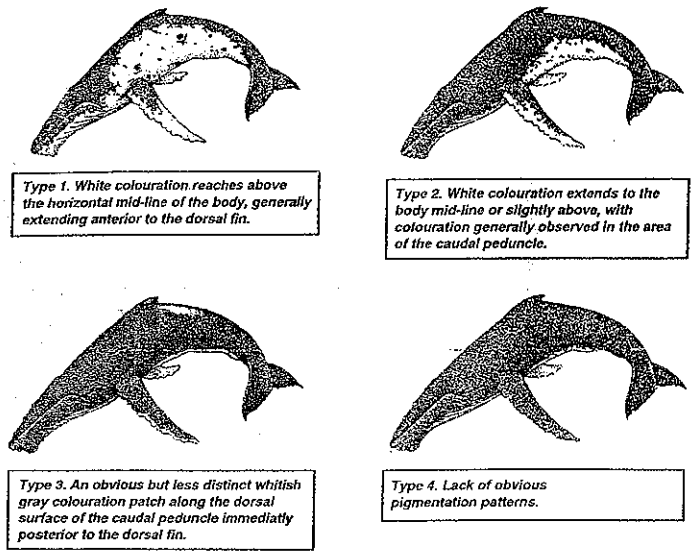

FIG. 8. Lateral body colouration patterns of humpback whales observed in the Southern Hemisphere, after Kaufman et al., 1987.

unclear. Albinism is a complex genetic defect in melanin production that results in partial or full hypo-pigmenation of the skin, hair and eyes, as well as abnormal development of oculoneural pathways (Oetting et al., 1996). The condition results when tyrosine is either not produced, or once produced is not properly metabolised into melanin. Albinism may involve any of a number of mutant alleles, resulting in a variety of phenotypes, ranging from partial to complete albinism. The mutant alleles may be autosomal recessive, autosomal dominant, or X-linked. Complete albinism, or tyrosinase-related oculocutaneous albinism (OCA1), is the result of recessive mutation in the structural locus for tyrosinase, which prevents melanin biosynthesis (Searle, 1990). OCA1 is generally associated with colourless skin, red irises and a variety of defects including mis-routing of the optic nerve and skin cancer. In contrast, ocular albinism (OA) affects only the eyes, but it also occurs in a number of varieties (Oetting et al., 1996). A number of complex diseases, such as Chediak-Higashi and Hermansky-Pudlak syndromes, include variations of albinism coupled with bleeding disorders and intestinal complications. Other pathological complications associated with hypo-pigmentation include lowered fertility, central nervous system defects and heightened susceptibility to infection (Hain & Leatherwood, 1982; Matkin & Leatherwood, 1986).

Analysis of photographs of the white whale raises three matters relevant to the question of albinism. A clear view of the eye is generally taken as the most direct means to determine whether albinism exists. There is no such view in any photograph to date although a distant image of the whale breaching (G. & M. Farrell, unpubl. photo) indicates faint pinkness in the eye region. An aerial image (Fig. 3), however, shows the region around the blowhole to be pink. While insufficient to diagnose albinism, observations so far are consistent with that conclusion.

A second point is related to the fact that humpback whales in the Southern Hemisphere normally show a great deal of white, compared with conspecifics of the Northern Hemisphere (Kaufman et al., 1987). When white areas are scarred by barnacles or by predatory strikes or other mishaps, the area scars black, at least initially and often permanently (Fig. 9). If the white whale was simply a 'normal' whale exhibiting an unusually large extent of what other normal whales display, then we should expect to find black marks anywhere that scars might have occurred. There is no such evidence. Barnacles can be observed on the tips of the flukes and in the ventral pleats, but there is no evidence of black scars in the 7 different years that photographs have been obtained. Based on the lack of pigment in scars, it is possible that the absence of colour in the white whale is the result of a mutant allele resulting in hypo-pigmentation similar to that associated with OCA.

A third feature is the presence of abnormal swelling and cyst-like protuberances in the head area. Photographs of the left sideof the head from 1992 (Fig. 10A) and 1998 (Fig. 10B) both show an unusual deformity around the blowhole region, that is unlikely to be associated with skeletal malformation. In addition there are numerous small bumps caused by some type of sub-dermal abnormality. A frequent side effect of albinism is susceptibility to skin cancer in the absence of ultraviolet protection generally afforded by the presence of melanin (Oetting et al., 1996). If indeed this whale suffers from OCA1, then we might expect over time to see

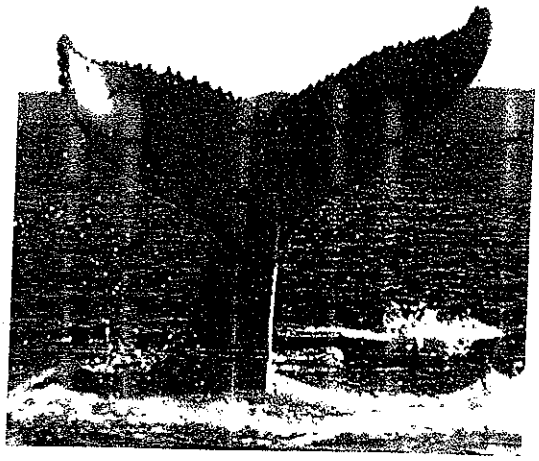

FIG. 9. Tail fluke of normally-coloured humpback whale showing white ventral surface with black marks on scarred areas.

evidence of skin abnormality. Evidence to date is circumstantial but it appears that this animal is suffering from a skin disorder, which may be related to its hypo-pigmented condition. Taken together, we believe the indications of pink around the blowhole, the absence of dark pigmentation in marks and scars and the presence of skin abnormalities provide strong evidence that the white whale is a true albino.

IS THE WHITE WHALE A 'SPECIAL INTEREST' WHALE? OCA is assumed to be a recessive trait in all mammals, although molecular studies of albinism in animals other than humans are relatively rare. The frequency of OCA in humans is approximately 1 in 17,000 (King & Summers, 1988), while the frequency of OCA1 is approximately 1 in 40,000 (Oetting et al., 1996). No frequency estimates are available for other species. Since OCA is due to homozygosity for a recessive allele, and the condition is associated with a number of health risk factors, one might expect adult albino humpback whales to be rare. When isolated populations are reduced to relatively small numbers, however (as is the case with east Australia humpback whales), an abnormally high rate of occurrence of homozygosity in recessive alleles may result from inbreeding. When the condition is associated with a high probability of foetal or neonatal mortality, the rate of occurrence might not be obvious without genetic testing of the population. In the absence of genetic data, the most we can conclude is that to the degree the hypo-igmentation of the subject whale is genetically determined, the overall population seems not to be experiencing a genetic bottleneck.

Since its appearance in 1991 the white whale has generated a high level of media and public interest. To minimise possible harm to the whale from overly-curious humans the Queensland Government has made legal provision to treat it as a 'special interest' animal, and given regional wildlife managers the latitude to enact special provisions such as increased distance regulations (Jeffery, 1994). Treating the white whale as a 'special interest' animal, as unique and worthy of singular attention, is important for ensuring that particular animal is not harmed. One of the more striking revelations from study of the white whale is that, except for an amazing appearance, it seems no more special than the few thousand of its conspecifics that must 'adapt' to the presence of humans during their annual sojourn off Australia's east coast. The patterns we have described in the sightings of the white whale are comparable to those we have observed in normally coloured whales over 17 years. Resource managers have expressed concern that humpback whales may be subject to a cumulative impact of contact with human activity — from the Snowy River to Airlie Beach and back (Stevens & Page, 1995). It has become clear that, with significant growth in recovering whale populations in many areas of the world, the incidence of ship strikes has risen dramatically (Laist et al., 2001). Growing evidence of harmful effects of recreational boat traffic on marine mammals (Kruse, 1991; Constantine, 2001; Nowacek et al., 2001) amplifies proposals for greater use of 'precautionary' approaches to the regulation of human activities in the vicinity of marine mammals (Meffe et al., 1999). The public fascination with the white whale may translate into coordinated efforts by all user groups to ensure the recovery of previously decimated marine mammal populations, including the humpback whales of east Australia, to their pre-exploitation levels (Hodda, 1996).

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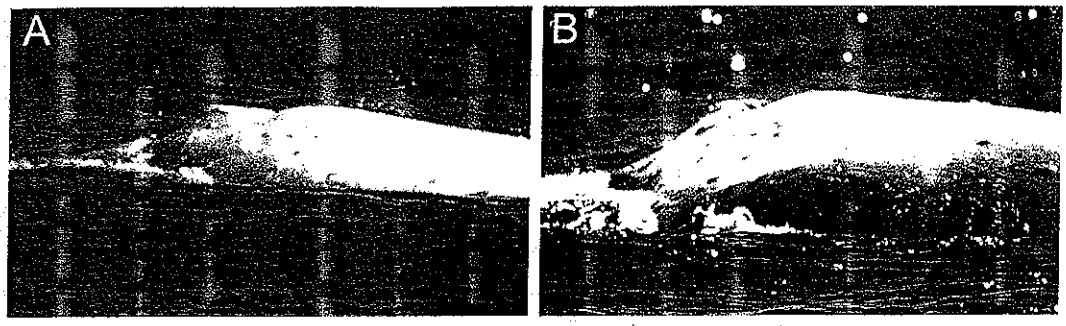

FIG. 10. White whale's head, left side, showing skin abnormalities; A, 1992: B, 1998.

provided important comments for the discussion on albinism. Photographs were provided by the Pacific Whale Foundation, except for Fig. 1 (Paul Hodda), Fig. 2B and Fig. 4A (Simon Allen). Figs 5 & 6 were prepared by Greg Luker of Southern Cross University. Southampton College of Long Island University provided the senior authour release time from teaching to complete this report. We thank Dr Robert Paterson for his enthusiastic encouragement of our work.

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APPENDIX

Details on each unique sighting of a white whale off east Australia, 1991 – 2000.

Date	Lat. Long. (°)	Location	Rel.	Pod Size	Activity	Dir.	Doc.	Comment
28/6/91	28.38, 153.38	Byron Bay	C	2 adults	Med Swim	N	Photo	P. Hodda
8/6/92	37.49, 148.37	Pt Ricardo, Vic.	A	2 Unk Sz	N/A	W	NA	Un-named surfer
9/6/92	37.49, 148.31	Snowy River, Vic	L	1 Ad, 1 Sub	N/A	?	NA	National Parks
10/6/92	37.21, 150.04	Green Cape, NSW	A	2 Adults	N/A	?	NA	Lay person
10/6/92	37.21, 149.55	Gabo Island, Vic	L	2 Unk Sz	N/A	?	NA	Lt Hse/Nat Prks
7/7/92	20.13, 149.00	Whitsundays, Qld	A	N/A	N/A	?	NA	Newspaper
8/7/92	19.47, 149.10	Bait Rf, Whitsundays, Qld	A	N/A	N/A	?	NA	Lay person
12/8/92	19.47, 149.10	Bait Rf, Whitsundays, Qld	C	1 Adult	Med Swim	?	Video	M. Wilson, Whitsunday Connection
13/8/92	20.13, 149.00	Hook Island, Qld	C	1 Adult	N/A	?	Video	Hamilton Island helijet, ref: H. Kobayash
13/9/92	24.55, 153.10	Hervey Bay, Qld	C	6 Adults	Resting	?	Photo	PWF, Many
14/9/92	24.55, 153.10	Hervey Bay, Qld	C	2 Adults	Active	?	Photo	PWF
?/10/92	27.00, 153.30	Moreton I, Qld	L	3 Unk Sz	Swim	S	NA	Lt Hse Kpr, Ref: R. Paterson
6/10/92	36.44, 150.00	Tathra, NSW	L	5 Unk Sz	N/A	?	NA	ComFshr, Ref: Roz Butt
8/10/92	37.05, 150.00	Eden, NSW	L	3 Unk Sz	N/A	?	NA	ComFshr, Ref: Roz Butt
21/6/93	35.08, 150.49	Jervis Bay, ACT	A	3 Unk Sz	N/A	?	NA	ComAbalone, Ref: Roz Butt
28/6/93	27.00, 153.30	Moreton I, Qld	L	2 Unk Sz	Swim	N	NA	LtHse, Ref: H. Kobayashi
8/8/93	20.55, 150.03	Kindermer Rf, Qld	A	7 Unk Sz	N/A	?	NA	Fishermen, Ref: H. Kobayashi
29/8/93	24.55, 153.10	Hervey Bay, Qld	C	1 Adult	Resting	?	Photo	Breach by G/M Farrell
30/8/93	24.55, 153.10	Hervey Bay, Qld	L	N/A	N/A	?	NA	DEH vessel
29/9/93	27.05, 153.30	Moreton I, Qld	C	2 Ad/1 Ca	N/A	?	Video	H. Kobayashi
24/12/93	41.49, 145.01	Granville Hbr, Tas	A	Mo/Ca	N/A	?	NA	Boat skipper
?/7/94	25.55, 153.25	Double I, Qld	A	N/A	N/A	?	NA	Newspaper
26/9/94	24.21, 153.09	Lady Musgreave I, Qld	A	N/A	N/A	?	NA	Fisherman
14/10/94	36.19, 150.15	Montague I, NSW	C	1 Subadult	Swim	S	Photo/ Video	R. Constable, NSW/NPWS
15/10/94	37.48, 149.18	Cape Everard, Vic	L	N/A	N/A	?	NA	Trawler skipper
9/7/95	23.50, 152.28	Lady Elliott I, Qld	A	N/A	N/A	?	N/A	Un-named pilot, newspaper report
16/ 7/95	28.38, 153.38	Cape Byron, NSW	C	1 Adult	Slow Swim	N	Photo	R. Thompson, Skipper
22/7/95	24.41, 153.21	Fraser I, Qld	C	2 Adults	Slow Swim	N	Photo	Fshr/Tassy II, Lay person
?/7/96	24.41, 153.21	Fraser I, Qld	L	N/A	Slow Swim	N	NA	PWF/Soundings
20/7/98	19.47, 149.10	Bait Rf, Whitsundays, Qld	L	3 Adults	N/A	NA	NA	PWF/Soundings
2/10/98	24.55, 153.10	Hervey Bay, Qld	C	2 Adults	Singer	NA	Photo	PWF/Song rec by T&W Franklin
?/6/99	32.41, 152.15	Port Stephens, NSW	L	N/A	N/A	?	NA	W. Hamilton
1/10/99	27.00, 153.30	Moreton I, Qld	L	1 Adult	N/A	?	NA	Lt Hse Kpr, Ref: R. Paterson
2/10/99	27.25, 153.33	Nth Stradbroke I, Qld	L	1 Adult	N/A	S	NA	R. Paterson
20/6/00	32.41, 152.15	Port Stephens, NSW	C	5 Adults	Active	NA	Photo/ Video	S. Allen/F. Future