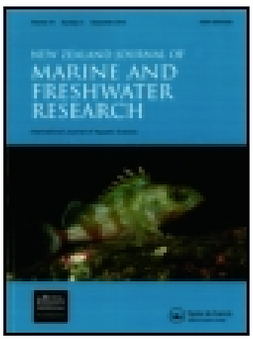

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Records of turtles and sea snakes in New Zealand, 1837–1996

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Abstract Seven species of turtles and sea snakes have reached New Zealand waters. Analysis of 207 records since 1837 shows that the two main species were *Dermochelys coriacea* and *Pelamis platurus*, followed by *Chelonia mydas*. Many marine reptiles probably came from Australian populations and were assisted or carried to New Zealand by the East Australian Current. A peak of records in 1989 coincided with an influx of tropical and subtropical fishes in north-eastern New Zealand. Nearly 70% of all marine reptile records were between January and May, with few records in winter and spring. Records for *D. coriacea* declined throughout the year, and the same was true for *Ch. mydas* except for a secondary peak in October. The summer–autumn peak in records for these two species may reflect an increased presence or activity during warmer weather. *P. platurus* occurred mainly from March to May and was absent from August to December, perhaps because no individuals survive after July. Marine reptiles were mostly recorded in the north of the North Island at 34–38°S latitude; only *D. coriacea* was widely reported further south. None of the turtles measured had carapaces below 375 mm long, except for *Caretta caretta* for which juveniles as small as 80 mm were recorded. These juveniles may have hatched at the *C. caretta* breeding grounds in south-east Queensland. All *P. platurus* were adults (>500 mm total length) but the smallest *Laticauda colubrina* was 295 mm. Nearly 70% of turtles, and some 80% of *P. platurus*, were alive when found. About 45% of turtles were washed ashore when found, and 41% were entangled in nets or lines, whereas 95% of *P. platurus* were found washed ashore.

Keywords marine reptile; turtle; sea snake; *Dermochelys*; *Chelonia*; *Caretta*; *Eretmochelys*; *Lepidochelys*; *Pelamis*; *Laticauda*; seasonality; distribution; size; state of health

INTRODUCTION

Turtles and sea snakes are widely distributed in the world's warmer waters (Halliday & Adler 1986; sea snakes absent from the Atlantic Ocean), and several species occur incidentally in the cool waters around New Zealand. Despite their wide distribution, marine reptiles are increasingly threatened by human activities, and there is a need for more data about their spatial and temporal distribution.

The first identified marine reptiles recorded in New Zealand were three sea snakes (*Pelamis platurus*) at Hokianga in 1837 (Polack 1838). The first turtle was a *Caretta caretta* (misidentified as *Chelonia mydas*) collected in the Manukau Harbour in 1885 (Cheeseman 1908; McCann 1966b). There has since been a steady trickle of reports, and seven species of turtles and sea snakes (Table 1) are now known to reach the New Zealand coast (Cheeseman 1893, 1908; Oliver 1911; Phillipps 1941; Graham 1964; McCann 1966b, 1969; Fordyce & Clark 1977; Ballance et al. 1986; Darby 1987; Tennyson et al. 1995).

McCann (1966b) recognised six species of marine reptiles in New Zealand, but Limpus & Roper (1977) pointed out that NMNZ R849, collected in the Wellington district in 1956, is *Lepidochelys olivacea* and not *Caretta caretta* as McCann supposed. A second specimen of this species was later found near Dunedin (Darby 1987).

The aims of this study were to assemble available records of marine reptiles in New Zealand in order to investigate historical, seasonal, and geographical patterns of distribution, and to describe the size and health of individuals.

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MATERIALS AND METHODS

I obtained records from the following sources: (1) publications (see References); (2) specimens lodged at museums (especially AIM, Auckland Museum, and NMNZ, Museum of New Zealand, Wellington); (3) the "Biosite" database of the Department of Conservation, Wellington; (4) a file of newspaper clippings held in the Natural History Unit of the Museum of New Zealand; and (5) my own file of records, mainly from the Auckland area since 1982, and including information from staff of Kelly Tarlton's Underwater World, Auckland.

I accepted only those records where the identity of the species was reported by a competent source, or where the identity was clear from photographs or descriptions. All records collated for this study have been supplied to the Biosite database.

Records from the subtropical Kermadec Islands (c. 1000 km north-east of New Zealand) and from the Chatham Islands (c. 900 km east of Christchurch) are given in Appendix 1 and omitted from the analysis of seasonality, so that the latter is for mainland New Zealand only.

Where I had opportunity to measure fresh or preserved specimens I recorded length along the curve of the carapace (turtles) or total length (sea snakes). For tightly-coiled preserved snakes that could not be straightened I ran a string along the mid-dorsal line and measured the string length. Some measurements were obtained from publications (e.g., Phillipps 1941; Fordyce & Clark 1977). I also accepted measurements given in newspaper articles where there was a degree of precision (e.g., "29 inches"). In newspaper reports it was never clear whether carapace length was taken along the curve of the carapace, but if other methods were used the discrepancy will be small.

Table 1 The seven species of marine reptiles recorded in New Zealand, and summary of the 207 records collated for this study.

Species	Earliest record	No. of records
Family Cheloniidae		
Loggerhead turtle		
Caretta caretta	1885	20
Green turtle		
Chelonia mydas	1895	37
Hawksbill turtle		
Eretmochelys imbricata	1949	18
Olive ridley turtle		
Lepidochelys olivacea	1956	2
Family Dermochelyidae		
Leathery turtle		
Dermochelys coriacea	1892	61
Family Hydrophiidae		
Yellow-bellied sea snake		
Pelamis platurus	1837	62
Family Laticaudidae		
Banded sea snake		
Laticauda colubrina	1880	7

RESULTS

General

The 207 records gathered for this study (Table 1) show that *D. coriacea* and *P. platurus* are the most frequently reported species, with c. 60 records each since last century. *Ch. mydas* is the third most commonly recorded species. *C. caretta* and *E. imbricata* are relatively uncommonly noted; *L. colubrina* and *L. olivacea* are rare.

The records are almost exclusively of single animals, one of the few exceptions being the finding of four *P. platurus* on Tokerau Beach, Northland, in March 1985.

Historical trends

Pelamis platurus was the first specifically identified marine reptile to be noted in New Zealand (1837). *C. caretta*, *Ch. mydas*, *D. coriacea*, and *L. colubrina* were first reported in the 1880s or 1890s (Table 1) whereas *E. imbricata* and *L. olivacea* were not noted until the middle of the present century.

The number of records has increased exponentially with time (Fig. 1), probably largely because the number of observers has increased in the same way. The relatively large number of records in the 1880s and 1890s is probably because of the interest of T. F. Cheeseman (1893, 1908). Likewise, the records up to the 1950s reflect the work of Charles McCann (1966a,b). The low number of records for the 1960s is unexplained. The data for the 1990s are incomplete, so the exponential trend may continue.

Figure 2 shows the number of records of marine reptiles per year for the 1980s and 1990s. The greatest number of records was in 1989. Francis & Evans (1994) noted a major influx of tropical and subtropical fish species in north-eastern New Zealand in 1988–90, coinciding with raised sea-surface temperatures. There was an earlier influx of marine organisms associated with elevated temperatures in 1969–75 (see Francis & Evans

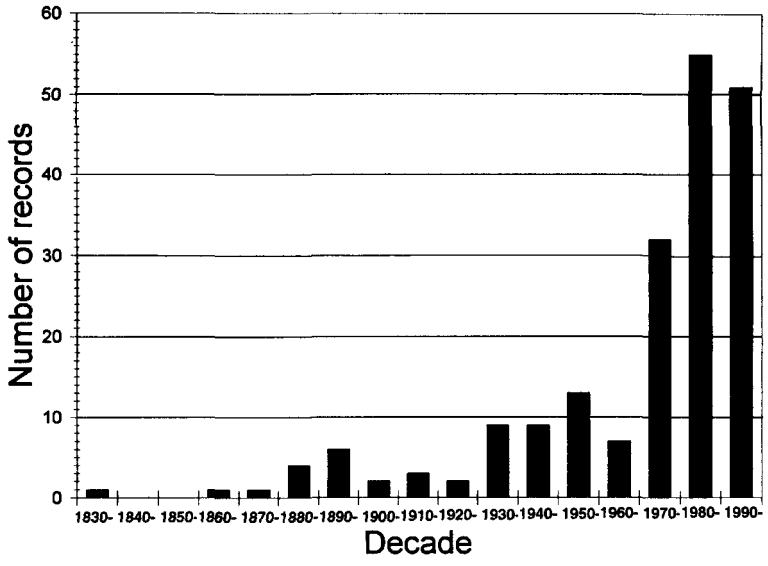

Fig. 1 Records of marine reptiles in New Zealand (all species combined; n = 196) grouped by decade from 1830–39 to 1980–89. Data for the 1990s are incomplete (1990–96).

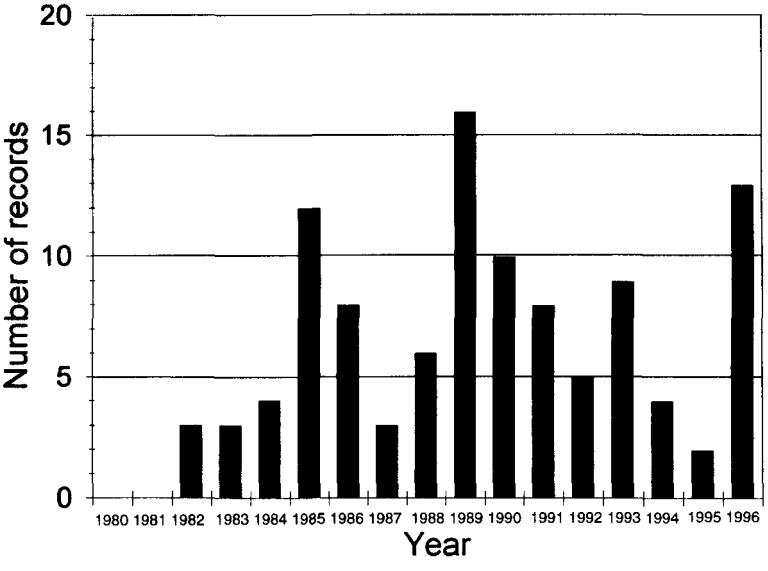

Fig. 2 Records of marine reptiles in New Zealand (all species combined; n = 106) for the years 1980–96.

1994). Marine reptile records for 1969–75 numbered 24, compared with six for the 7-year period before and 12 for the 7-year period after.

Seasonality

Reports of marine reptiles in New Zealand fell mainly between January and May (67% of records for seven species combined, n = 179). There were few records in winter (June–August, 18%) and spring (September–November, 13%). November and December were the poorest months for records (two and four records, respectively).

Figure 3 shows the seasonal distribution of records of the four main turtles. *D. coriacea* (Fig. 3A) shows a steady decline in records throughout the calendar year, and the pattern is significantly different from uniform (grouping months into pairs beginning January + February, chi-squared for 5 d.f. = 33.8, $P < 0.001$). For *Dermochelys* 76% of records fell between January and May, and there

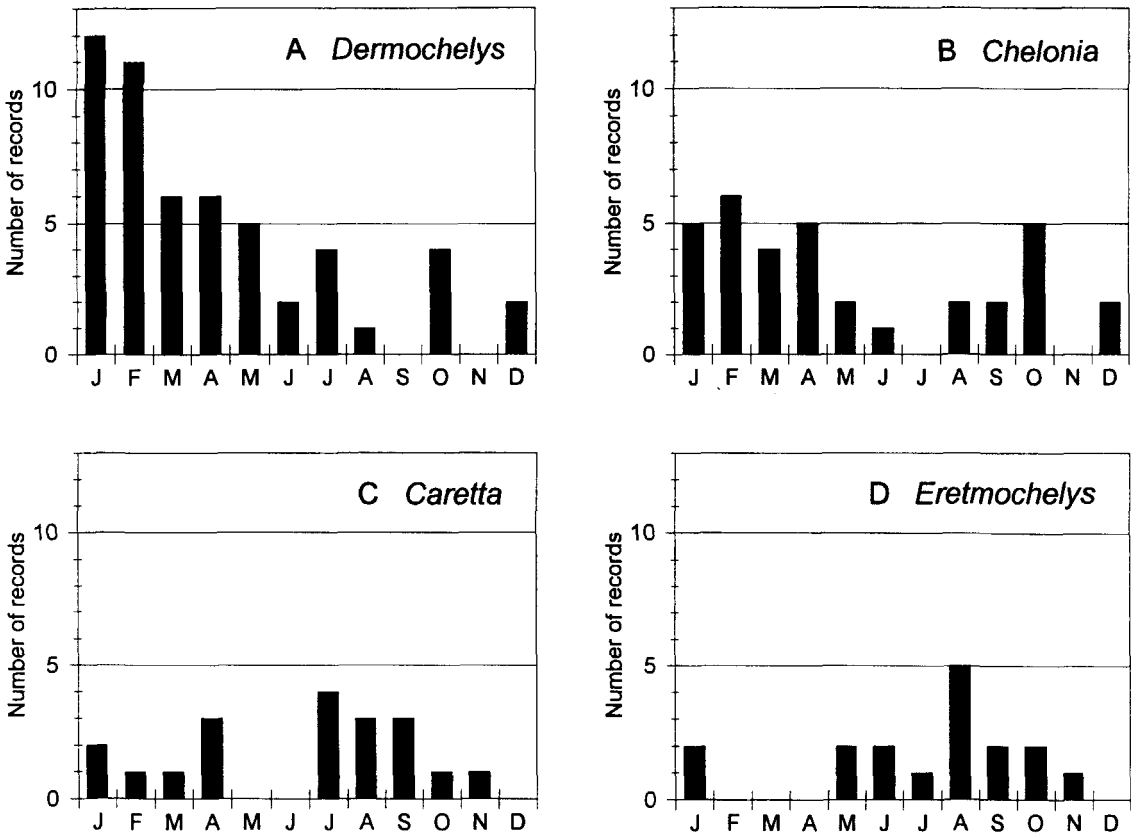

Fig. 3 Distribution by month of records of: **A**, *Dermochelys coriacea* ($n = 53$); **B**, *Chelonia mydas* ($n = 34$); **C**, *Caretta caretta* ($n = 19$); and **D**, *Eretmochelys imbricata* ($n = 17$).

were few records in winter and spring. *Ch. mydas* (Fig. 3B) shows a similar pattern with the bulk of records (59%) between January and April, but unlike *D. coriacea*, *Ch. mydas* had a second peak of records in spring (October). The pattern differs significantly from uniform (months in pairs as above, chi-squared for 5 d.f. = 13.3, $P < 0.05$).

The fewer records of *C. caretta* (Fig. 3C) and *E. imbricata* (Fig. 3D) were not significantly different from a uniform distribution (comparing first 6 months with second 6 months by chi-squared test).

Pelamis platurus (Fig. 4) showed a different seasonal pattern from that of the turtles. It was absent from New Zealand between August and December, and 76% of records were in autumn (March–May). The distribution of records from January to July was significantly different from uniform (chi-squared for 6 d.f. = 28.0, $P < 0.001$).

A consideration of whether summer records (December–April inclusive, when water temperatures are warmest) accounted for all the southernmost New Zealand records showed that this was not the situation for any species.

Distribution

For mainland New Zealand all species were recorded predominantly in the north (north of Hamilton) at c. 34–38°S latitude. *D. coriacea* (Fig. 5C) was the only species that was also widely recorded further south, where the remaining turtles were rare. *Ch. mydas* (Fig. 5A) was recorded once in Cook Strait (December 1989) and only twice in the South Island (Tasman Bay, March 1971, and Birdlings Flat, June 1987). The only South Island records of *C. caretta* were at Mason Bay, Stewart Island (April 1986, Ballance et al. (1986)), and Greymouth (January 1975). Of the 18 North

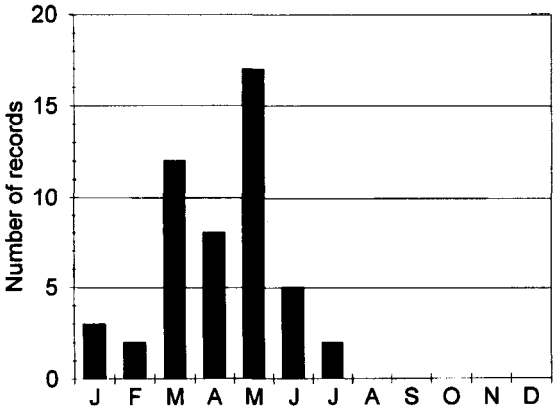

Fig. 4 Distribution by month of records of *Pelamis platurus* ($n = 49$).

Island records of *C. caretta*, only four were from the southern end (Fig. 5B). *E. imbricata* has never been reported in the South Island. Except for a record at Palliser Bay near Wellington (June 1982) it has not been found south of Hamilton (Fig. 6A). Records for the Kermadec and Chatham Islands are given in Appendix 1.

Pelamis platurus (Fig. 6B) has only one South Island record (Pakawau, Golden Bay, March 1974), and only six North Island records south of a line from Cape Egmont to East Cape. The southern-most record of *L. colubrina* was at Castlepoint, Wairarapa (August 1977). All other *L. colubrina* records were from the north-east coast of the North Island between the Bay of Islands and East Cape.

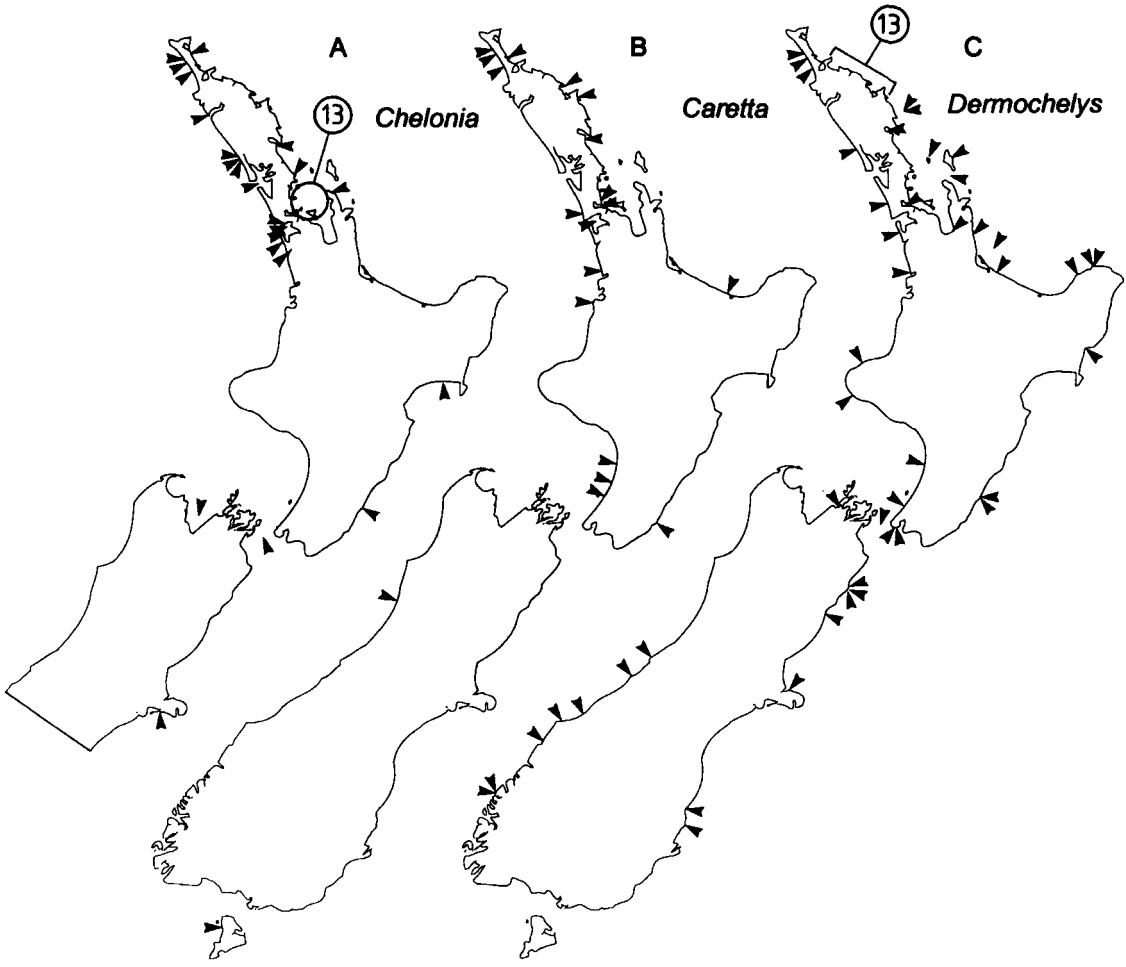

Fig. 5 Geographical distribution of records of: **A**, *Chelonia mydas* (1895–1996; $n = 35$); **B**, *Caretta caretta* (1885–1996; $n = 20$); and **C**, *Dermochelys coriacea* (1892–1996; $n = 59$).

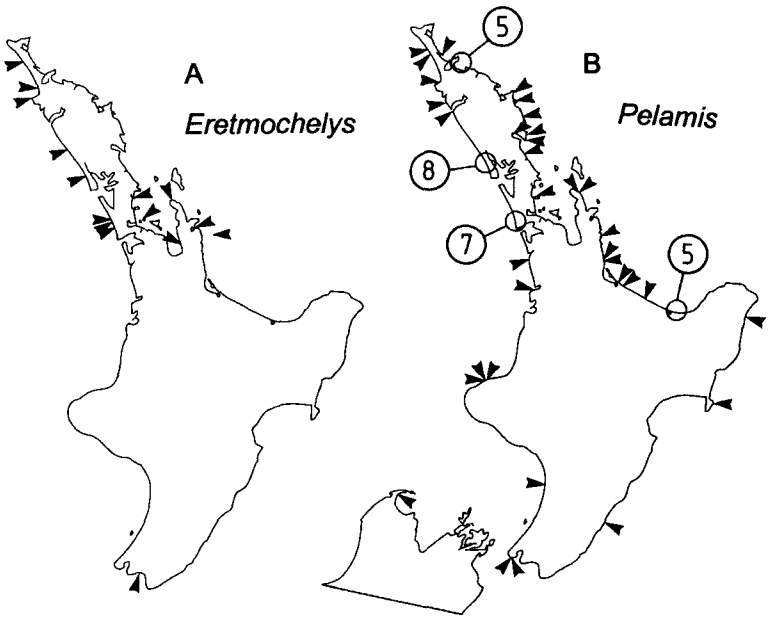

Fig. 6 Geographical distribution of records of: **A**, *Eretmochelys imbricata* (1949–94; $n = 15$); **B**, *Pelamis platurus* (1837–1996; $n = 59$).

Size

The lengths, where known, of marine reptiles recorded in New Zealand are summarised in Table 2. Carapace lengths were available for only seven *D. coriacea*, and all were large, the smallest (910 mm) being larger than any other turtle. No *Ch. mydas* or *E. imbricata* was below 375 mm long; all turtles below this length were *C. caretta*.

Caretta caretta is the only species for which small juveniles have been recorded in New Zealand. Seven *C. caretta* had carapace lengths <200 mm. One was 170 mm, and six were 80–100 mm. These juveniles were recorded in April 1949 (1), August–September 1952 (2), July 1973 (1), July 1986 (1), and October–November 1996 (2).

All *P. platurus* were above 500 mm, whereas half the *L. colubrina* were smaller than this.

State of health

Turtles

Each of the four main species of turtles was more often found alive than dead. Of 72 turtles in total where the information was recorded, 67% were alive when found. In a sample of 69 turtles (alive or dead when found), 45% were washed ashore (i.e., "beached") when found, 41% were entangled by nets or lines in some depth of water, and the remaining 14% were swimming freely. Table 3 gives details of the state of health of 14 individuals.

Sea snakes

Most *P. platurus* (79% of 38) were alive when found. Unlike the turtles, no sea snakes were entangled—given their shape and flexibility, entanglement is presumably not a hazard. In a

Table 2 Size (mm) of 49 turtles (curved carapace length) and 45 sea snakes (total length) recorded in New Zealand. In addition, one *L. olivacea* measured 610 mm.

Species	Mean	s.d.	*n*	Range
Caretta caretta	272.2	211.6	14	80–680
Chelonia mydas	561.4	148.1	20	415–900
Dermochelys coriacea	1376.7	230.0	7	910–1600
Eretmochelys imbricata	594.6	202.3	8	375–900
Laticauda colubrina	567.5	246.3	6	295–905
Pelamis platurus	754.1	116.1	39	510–1155

sample of 38 *P. platurus* (alive or dead when found), 95% were washed ashore, and only two were found swimming freely (one of them up a stream near the sea). In the few instances where these details are known for *L. colubrina*, all were washed ashore alive.

Several sea snakes were found alive inland from the coast: *P. platurus*, New Plymouth, April 1938 (on a lawn 3 chains (60 m) from the sea); *P. platurus*, Table Cape, Mahia Peninsula, May 1938 ("some distance" from the sea); *L. colubrina*, Whangaruru Harbour, January 1990 ("well above" the high-tide line). *L. colubrina* is reasonably good at terrestrial locomotion; *P. platurus* is not. W. J. Phillips (*Dominion* 23 June 1938) suggested that the presence of the *P. platurus* inland at Mahia was a result of disorientation caused by the partial blindness of the snakes out of water. I suggest that sea snakes could be carried inland by birds such as raptors or gulls.

Less easily explained, a *L. colubrina* (AIM H648) was found alive at Te Aroha, near Hamilton, in September 1945. Te Aroha adjoins the Waihou River but is 44 km in a straight line from its mouth, and further by the meandering path of the river. In another direction Te Aroha is 20 km from an estuary across a range of hills.

DISCUSSION

The records gathered for this study obviously represent only a small proportion of the total number of marine reptiles that have reached New Zealand. Sampling biases may mean that the records do not reflect actual patterns of relative abundance. The concentration of records in northern New Zealand where waters are warmest seems real, but may be exaggerated by the greater number of observers in the north. People spend more time at the coast in

Table 3 Health and condition of 14 turtles caught or washed ashore in New Zealand (all alive when found except Record 14). Records 2–6 and 9–13 from staff of Kelly Tarlton's Underwater World, Auckland. Size is length (mm) along curve of carapace.

Record	Date found	Locality	Size (mm)	Comments
(1) *Chelonia mydas*	Oct 1984	Waitemata Harbour	545	Sickly, soon died; large goose barnacle (*Lepas anatifera*) on carapace
(2) *Ch. mydas*	Apr 1985	off Tiritiri Matangi I.	450	Died of lung infection after 15 months in captivity
(3) *Eretmochelys imbricata*	Sep 1985	Whitianga	660	Female; septicaemia; died after 4 days
(4) *Caretta caretta*	Jul 1986	Piha Beach	170	Nearly doubled in length during 2 years in captivity
(5) *E. imbricata*	May 1987	off Rakino I.	435	Emaciated; lived >1 year in captivity
(6) *Ch. mydas*	Jun 1987	near Lake Ellesmere	450	Male; pneumonia, gastric ulceration; died after 7 days; polythene sheet 90 × 40 mm in gut
(7) *E. imbricata*	Oct 1989	Cape Colville	375	Algae, tubeworms, barnacles of local inshore spp. on carapace and plastron
(8) *C. caretta*	Sep 1990	Otaki Beach	330	Marine growth, including barnacles, on carapace
(9) *Ch. mydas*	Aug 1992	Karioitahi Beach	630	Lesions on neck & forelimbs; pneumonia, dehydration, heart flukes; after 9 months in captivity increased from 21 to 26 kg
(10) *Ch. mydas*	May 1993	Manukau Harbour	415	7.7 kg; pneumonia
(11) *Ch. mydas*	Oct 1993	Northland	<400	11.2 kg; fungal granuloma in left lung; died in captivity after 1 month
(12) *Ch. mydas*	Mar 1994	off Kawau I.	560	22.5 kg; released after ? interval at 30 kg
(13) *Ch. mydas*	Aug 1994	coast near Dargaville	440	8.5 kg; pneumonia, dehydration; released after 10 weeks at 10.5 kg
(14) *C. caretta*	Oct 1996	Bland Bay, Northland	94	Small, stalked barnacle (*Lepas pectinata*) on neck; larger, sessile balanoid barnacle on forelimb

summer than in winter, but there were fewest records in November–December suggesting that this factor did not significantly bias results.

McCann (1966a) suggested that marine reptiles stranded in New Zealand may have arrived by way of the East Australian Current. This current flows south along the east coast of Australia, east across the northern Tasman Sea, then south-east along the edge of the continental shelf of the north-eastern North Island (see references in Francis (1993) and Francis & Evans (1994)). It is likely that New Zealand receives many of its marine reptiles as stragglers from Australian populations to the north-west, but others may originate from Papua New Guinea, the Solomon Islands, Vanuatu, New Caledonia, and Pacific islands further east.

Dermochelys coriacea, the most widely distributed of all turtles, is the only marine reptile seen regularly in southern New Zealand waters. In the North Atlantic, this turtle migrates annually northwards to cold-temperate waters (42–44°N latitude) to feed (Shoop & Kenney 1992). The presence of *D. coriacea* around New Zealand may represent similar deliberate feeding excursions into temperate waters.

The nearest *D. coriacea* breeding ground to New Zealand is south-east Queensland, where very limited breeding takes place (Limpus et al. 1984). *D. coriacea* also breeds in Papua New Guinea and the Solomon Islands. Limpus & McLachlan (1979, fig. 4) showed that the predominant currents in the Coral and Tasman Seas might carry *D. coriacea* from islands north of the Coral Sea to eastern Australia. The currents carry on towards New Zealand. In southern Queensland, most *D. coriacea* were sighted in December, suggesting "that relatively large numbers of leatherbacks pass through southern Queensland waters during the midsummer months only." The peak of New Zealand *D. coriacea* sightings in January and February (Fig. 3A) may be part of the same movement.

Turtles with most records in summer–autumn (*D. coriacea* and *Ch. mydas*) may be showing increased presence or activity during times of higher sea temperatures. Among New Zealand fishes a similar pattern is believed to exist with oceanic wanderers like tunas, marlins, and various sharks (M. P. Francis pers. comm.). The peaks of marine reptile records in 1969–75 and 1988–90, matching influxes of other marine creatures and coinciding with raised sea-surface temperatures (Francis & Evans 1994), suggest that temperature fluctuations are a major factor influencing the occurrence of the reptiles.

Records of *C. caretta* and *E. imbricata* peaked in July–August (Fig. 3C,D). This could represent high mortality of individuals unable to return north after the onset of colder sea temperatures around New Zealand.

Hatchlings of *C. caretta* disperse at sea, and the small juveniles found in New Zealand in certain years may have drifted from south-east Queensland where the species nests (Gyuris & Limpus 1988). They also breed in New Caledonia (anonymous referee pers. comm.).

The finding of a very small live *C. caretta* (carapace length c. 80 mm; probably within 6 months of hatching) at East Beach, Houhora, in July 1973, elicited unconfirmed reports of turtle tracks on beaches. The supposition followed that turtles might be successfully breeding in the Far North. "Strange tracks like those made by turtles have been reported in the past on Spirits Bay Beach and the Ninety Mile Beach. ... turtle tracks leading from the sea to the sandhills on Tom Bowling Bay have definitely been seen on several occasions in late summer" (*Northland Age* 27 July 1973).

It is unlikely that turtles have bred on the New Zealand shore, even in the vicinity of Houhora (35°S latitude). There are isolated records of *C. caretta* nesting on New Jersey (United States) beaches at 40°N latitude (G. R. Zug pers. comm.), but the furthest south turtles have attempted nesting in eastern Australia is in the Newcastle area (anonymous referee pers. comm.) at c. 33°S latitude, which is north of New Zealand.

A large sample of *C. caretta* resident in Moreton Bay, south-east Queensland, had carapace lengths of 701–1045 mm (Limpus et al. 1994a). None of the 14 *C. caretta* measured in New Zealand (70% of those recorded) exceeded 680 mm, indicating a strong bias towards juveniles and immatures. A large sample of *Ch. mydas* at Moreton Bay measured 388–1191 mm (Limpus et al. 1994b). All *Ch. mydas* measured in New Zealand were within this range (Table 2) indicating no bias towards small juveniles for this species.

Marine reptiles in New Zealand were usually alive when found. Veterinary examination of turtles received by Kelly Tarlton's Underwater World showed that many exhibited health problems (Table 3). Several turtles had fouling organisms on their carapace or limbs. However, neither ill-health nor

fouling growth is necessarily unusual. In south-east Queensland c. 10% of large samples of *C. caretta* and *Ch. mydas* had health problems or injuries, and barnacles and the like were common (Limpus et al. 1994a,b).

Pelamis platurus is truly pelagic (Kropach 1975), yet nearly all specimens recorded in New Zealand were washed ashore, indicating distress. This snake is a weak swimmer that moves passively in surface currents (Kropach 1975). In the Gulf of Panama the major cause of mortality of *P. platurus* is being swept by currents either ashore or into areas of lethally cold water (Kropach 1975). Individual *P. platurus* cease feeding in sea temperatures below 18°C (Priede 1990) and the lower lethal limit is possibly between 14.5 and 17°C (Dunson & Ehlert 1971). Most *P. platurus* stranding in New Zealand probably suffer cold-shock, although cold is not the only cause of stranding, since strandings (often associated with storms) occur on the coast of southern Mexico (Dunson & Ehlert 1971).

There is a permanent breeding population of *P. platurus* off the central coast of New South Wales, individuals of which wash ashore throughout the year with a peak in July (Cogger 1975). This is very unlike the pattern in New Zealand with strandings of *P. platurus* concentrated in March, April, and May (Fig. 4). The autumn peak of records in New Zealand may reflect individuals that sicken and are cast ashore as sea temperatures fall. None may survive after July—hence the absence of August–December records. Certain tropical fishes that straggle to New Zealand show similar patterns (M. Francis pers. comm.). Dunson & Ehlert (1971) listed New Zealand among localities considered too cold for the year-round presence of *P. platurus*.

The average length of several hundred *P. platurus* in the Gulf of Panama was 514 mm for males and 542 mm for females (Kropach 1975). New Zealand specimens, with an average length of 754 mm, are therefore large. Individuals above 500 mm are adults (Kropach 1975) and all New Zealand specimens exceed this length.

Laticauda colubrina is common among the islands of the south-west Pacific (e.g., Fiji, Ryan 1988), but is thought not to have a resident population in Australia and is only occasionally found on the Australian east coast (Cogger 1992). The corresponding scarcity of this species in New Zealand argues for the importance of the East Australian Current in bringing marine reptiles to New Zealand.

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Appendix 1 Records from the Kermadec and Chatham Islands, New Zealand.

Kermadec Islands

The Kermadec Islands, at 30°S latitude, ought to be more conducive to the sustained presence of marine reptiles than mainland New Zealand, but records are few. Oliver (1911) reported *Chelonia mydas* at Raoul Island in May 1908. Francis (1986) illustrated an *Eretmochelys imbricata* photographed at Egeria Rock, between Raoul Island and the Meyer Islands, on 27 October 1985 (M. P. Francis pers. comm.). In May 1992 John Young encountered a *Ch. mydas* while diving at Denham Bay, Raoul Island (identified from video footage by M. Francis pers. comm.).

Groups of up to six *Ch. mydas* have been noted in the near-shore waters around Raoul Island, especially from January to March (Oliver 1911). They are probably immatures that settle to forage after post-hatchling dispersal from a rookery in Queensland or on a nearby Pacific island. Breeding at the Kermadecs has not been reported.

Chatham Islands

A. Cox saw a *Dermochelys coriacea* in Pitt Strait, between Chatham and Pitt Islands, in December 1979 (M. McGlynn pers. comm.). In March 1992 Greg Gibbs found a partial corpse of a *D. coriacea* floating 30 nautical miles north of Chatham Island.