The Status of Dugongs, Sea Turtles and Dolphins in the Inshore Region of the Great Barrier Reef Marine Park South of Cape Bedford

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EXECUTIVE SUMMARY

- In November-December 1992, dugongs, sea turtles and cetaceans were counted from the air at an overall sampling intensity of 10% over a total area of 39,183 km^2 in the inshore waters of the Great Barrier Reef region south of Cape Bedford. This survey was a repeat of the surveys conducted in 1986/87.

- The population estimates for dugongs and sea turtles were corrected for perception bias (the proportion of animals visible in the transect which are missed by observers), and standardised for availability bias (the proportion of animals that are invisible due to water turbidity) using survey and taxon-specific correction factors. The estimates for cetaceans were corrected for perception bias only. Because the availability correction factors are likely to be conservative, the population estimates quoted here are probably underestimates. The corrections for availability bias do not completely compensate for differences in sightability due to weather conditions and these were further adjusted using Beaufort Sea State as a covariate when comparing the results of the 1986/7 and 1992 surveys.

- Even when Beaufort Sea State was used as a covariate in the analyses, there was a high probability ($p = 0.0668$) that the minimum population estimate for dugongs for the survey area in November-December 1992 (1,857 $\pm$ s.e. 292 dugongs), was significantly different from the estimate for the same region in 1986/7 using the same aerial survey technique (3,479 $\pm$ s.e. 459). This trend may reflect a real decline or be an artefact of differences in survey conditions. However, corresponding differences between surveys were not found for turtles or dolphins suggesting that there is serious cause for concern about the status of the dugong in the survey area. There are no data on the possible causes of any decline such as habitat deterioration and mortality from incidental fishing and traditional hunting. There are anecdotal reports of seagrass dieback in some areas. If the number of dugongs taken by traditional hunters approaches the number for which permits are issued, this take is almost certainly unsustainable.

- Most of the turtles sighted during this survey were probably large green turtles. The minimum population estimate in November-December 1992 was 33,291 $\pm$ s.e. 5182 turtles compared with 26,393 $\pm$ 1,515 for the same region in November 1985. Both with and without Beaufort Sea State as a covariate, the difference between the minimum population estimates obtained in 1986/7 and 1992 was not significant, but there was a significant interaction between block and time suggesting a temporal change in distribution. However, aerial surveys are not nearly as satisfactory for turtles as for dugongs, due to: (1) the sensitivity of turtle sightings to small changes in sighting conditions which cannot be completely removed in the analyses; (2) the tendency of turtles to migrate to breed coincident with the timing of the surveys, and; (3) the likelihood of missing juvenile turtles that are too small to be seen from the air. The major value of the turtle sightings

is in the identification of important habitats rather than in the estimates of abundance *per se*.

- All the cetaceans sighted were dolphins. Most of the animals appeared to be bottlenose dolphins, *Tursiops truncatus,* or Indo-Pacific humpback dolphins, *Sousa chinensis*. The population estimates for November-December 1992 sum to 11,928 ± s.e. 682 dolphins for the whole region compared with 6,743 ± s.e. 542 dolphins in 1986/1987. Irrespective of whether or not Beaufort Sea State was used as a covariate in the analyses, there was no significant difference in dolphin density between the two sampling times and no interaction between block and time.

- While we have made minimum population estimates of turtles and cetaceans within the survey zone, these estimates should be considered with caution. The survey design is based on prior knowledge of dugong distributions and the factors limiting them. Therefore we have excluded areas such as the offshore reefs where seagrasses and dugongs are rarely found, even though these may be important habitats for turtles and cetaceans.

RECOMMENDATIONS

1. That the management of dugongs, sea turtles and dolphins in the Southern Section of the Great Barrier Reef be directed at reducing all impacts on their numbers, including habitat loss and mortality from fishing and indigenous hunting as proposed in the draft Conservation Strategy for Turtles and Dugongs in the Great Barrier Reef region.

2. That in order to verify the decline in dugong numbers suggested by comparing the results of the surveys conducted in 1986/87 and 1992, the Mackay-Capricorn and Central Section sectors of this survey be repeated in November-December 1994. (November is the month when favourable weather conditions are most likely.) The survey crew should include at least two suitably trained Aboriginal observers (preferably from the staff of GBRMPA or QDEH).

3. That in order to investigate local changes in the distribution and abundance of dugongs, the region between Dunk Island and Cape Cleveland be surveyed when weather conditions are favourable every two months for one year in association with local QDEH ranger staff.

4. That the Department of Primary Industries repeat their surveys of seagrass beds in this region to verify the extent of any dieback using the dugong distribution as a basis for planning the survey.

5. That a marine consultant with a good rapport with the commercial fishing industry be funded to develop a scheme to **monitor and verify** the by-catch of dugongs and turtles in the southern Great Barrier Reef region. The scheme should encourage fishers to donate their incidental catch of dugongs and turtles to local Aboriginal communities.

6. That co-management systems, similar to the Council of Elders established in centres such as Mackay and Townsville, be developed in other centres where there are significant numbers of indigenous people who want to hunt dugongs and turtles. These councils should be charged with developing methods of recording catch and minimising traditional hunting in a culturally acceptable manner in this region.

7. That each Council of Elders be asked whether they would like assistance in developing a culturally appropriate education program to encourage their people to take further responsibility for managing their dugong harvest.

8. That discussions be held with the Councils of Elders about conducting a survey to determine the hunting aspirations of urban Aborigines and Islanders in this region to assist the Councils in developing sustainable harvest practices for dugongs.

9. That consideration be given to increasing the protection of dugongs in regionally important areas such as Hinchinbrook Island, Cleveland Bay, Upstart Bay and Shoalwater Bay.

INTRODUCTION

In 1986 and 1987, Marsh and Saalfeld (1990a) [see also Marsh, 1992] counted dugongs, dolphins and sea turtles during an aerial survey over an area of some 39,000 km² in the inshore waters of the Great Barrier Reef Marine Park south of Cape Bedford. Survey-and-taxon specific correction factors were used to correct for perception bias (the proportion of animals visible in the transect which are missed by observers) and to standardise for availability bias (the proportion of animals that are invisible due to water turbidity). The area was resurveyed in November-December 1992 using the same technique. This report compares the results of this survey with those of the earlier surveys to present an overview of the current status of dugongs, sea turtles and dolphins in this region.

METHODS

The inshore waters between 5nm south of Cape Bedford (15° 19'S) and the southern boundary of the Great Barrier Reef Marine Park (24° 30'S) were surveyed between 13 November and 12 December 1992. In order to increase repeatability, the survey was conducted only when the weather conditions were good (usually Beaufort Sea State $\leq$ 3; Table 1 and Appendix Table 1)). Whenever possible, daily schedules were arranged to avoid severe glare associated with a low or midday sun.

Survey Design

Aerial survey methodology has been detailed by Marsh and Sinclair (1989a and b) and Marsh and Saalfeld (1989a). The transect width (200m on either side of the aircraft at survey altitude) was demarcated with fibre glass rods attached to artificial wing struts on either side of the aircraft. Each sighting was recorded as being made in the upper, middle or bottom third of the transect to facilitate deciding whether simultaneous sightings by tandem observers were of the same group of animals.

Transects were flown in an east-west direction and usually extended 21.6km from the coast and/or off shore islands except between Hinchinbrook Island and the mainland where mountains made east-west flying dangerous. Transects were spaced 5' latitude apart, except where sampling intensity was increased due to the presence of large seagrass beds. Figures 1a, b, c show the locations of transects in the Mackay-Capricorn, Central and Cairns Sections of the Great Barrier Reef Marine Park respectively. A global positioning system mounted in the aircraft facilitated accurate navigation. The aircraft was also fitted with a radar altimeter for accurate height control.

Correction Factors

Population estimates were calculated separately for dugongs, turtles and dolphins. The estimates were corrected for perception bias (the groups of animals visible on the transect line that were missed by observers) and availability bias (the groups

of animals unavailable to the observers due to water turbidity). The corrections for perception bias were calculated using the Peterson Mark-Recapture Model on the basis of the proportion of the relevant sightings seen by one (specified) or both members of each tandem team (Marsh and Sinclair, 1989a). Availability bias corrections for dugongs were calculated by standardising the proportion of dugongs sighted during the survey to the number seen on the surface in clear water where all dugongs were potentially available (Marsh and Sinclair, 1989a). Availability correction factors for turtles were calculated by standardising the proportion of turtles seen during the survey against the number sighted at the surface in Blocks 8 to 13 in the Northern Great Barrier Reef (Marsh *et al.*, 1993). The proportion of turtles sighted at the surface on this survey was the lowest of any survey we have undertaken. The corrections for availability bias for both dugongs and turtles both make the untested assumption that a constant proportion of the target taxon is at the surface. The availability correction factor for turtles does not account for the variable proportion of individuals that are too small to be seen from the air. No identification to species is possible for turtles; the estimate is an overall one for all five species of turtles found on the GBR. Availability bias was not corrected for in the case of dolphins due to the lack of suitable data to use as a standard.

Analysis

As the transects were variable in area, the Ratio Method (Jolly, 1969; Caughley and Grigg, 1981) was used to estimate the density, population size and associated standard errors for each taxon for each block (Figures 1a, b, c). Any statistical bias resulting from this method is considered inconsequential due to the relatively high sampling intensity (Table 2, see also Caughley and Grigg, 1981). The standard errors of the population estimates were adjusted to incorporate the errors associated with the various correction factors as outlined in Marsh and Sinclair (1989a).

Differences between this survey and the previous surveys in the densities of dugongs, turtles and dolphins per block, were tested using analysis of variance with and without modal Beaufort Sea State for each transect as the covariate. Fixed factors in the model were time and block. Transect was treated as a random factor nested within block. The densities were log transformed ($\log10(x+1)$) in order to equalise the error variances. All significance tests were two tailed.

Density diagrams, adjusted for sampling intensity, were produced using the Arc/Info GIS package. Depending on the sampling intensity, a coverage of 2.5 x 2.5 nm or 5 x 5 nm square grids overlaying the survey area was used to calculate the densities of dugongs, turtles and dolphins. Density in each cell was calculated as:

Density km^{-2} = Corrected no. animals in each cell / Area surveyed in cell

where, Area surveyed in cell = Transect length in km * Transect width (i.e. 0.4 km)

DUGONGS

Results and Discussion

Group Size and Composition

A total of 101 dugongs was sighted during the 1992 aerial survey. The size and composition of the groups sighted are summarised in Figure 2. Three groups each of four dugongs in Shoalwater Bay, Repulse Bay and near Hinchinbrook Channel respectively were the largest seen.

Of all the animals sighted in the Mackay-Capricorn and Central Sections of the Great Barrier Reef, 72% were single dugongs or cow-calf pairs (Figure 2). In the northern Central Section (from Cape Cleveland near Townsville north), the proportion of calves was 13%, compared with 0% in the southern Central Section, and 11% in the Mackay-Capricorn Section.

Population and Density Estimates

The mean group sizes and correction factors used to calculate the population and density estimates in 1992 are given in Table 3. Appendix Tables 3, 4 and 5 list the raw data. The estimates of density and numbers of dugongs in the various blocks in the survey area 1992 are given in Table 4. Appendix Figures 1 through 6 are maps of the dugong sightings in the Central and Mackay-Capricorn Sections of the Great Barrier Reef Marine Park in 1992.

The highest densities of dugongs were associated with inshore seagrass beds (Figures 3a and 4a). Shoalwater Bay (southern Section Block 5) was confirmed as the most important dugong habitat in the Great Barrier Reef region south of Cape York (Table 4). The Central Section north of Townsville also supports several hundred dugongs (Table 4).

As in 1987, the number of dugongs sighted between Dunk Island and Cape Bedford was insufficient to estimate the population size in 1992 (Appendix Figure 6). A minimum population estimate of 1857 ± s.e. 292 dugongs at an overall density of 0.05 ± s.e. 0.007 dugongs km^{-2} was calculated for the remainder of the region on the basis of the 1992 survey (Table 4).

Differences between Surveys

As in 1986-87 (Marsh and Saalfeld, 1990a), dugong group sizes were small in 1992. In addition, densities were generally low in the southern half of the Great Barrier Reef Marine Park in both 1986/7 and 1992 compared with the other regions surveyed in northern Australia (Table 5). This can, at least partially, be attributed to differences in habitat availability. The area of known seagrass in the southern Great Barrier Reef Marine Park is small (e.g. approximately 550 km^2) in comparison with the northern regions of the Park (2407 km^2, Lee Long *et al.*, 1993). The regional differences in seagrass area are likely to be greater than indicated by these

estimates as the bathymetry of the region suggests that unsurveyed offshore and reefal seagrass beds are probably much more extensive in the northern regions of the Great Barrier Reef Marine Park than in the area from Cape Bedford south.

The minimum dugong population estimated for the Mackay-Capricorn and Central Sections of the Park was significantly lower than the corresponding values in 1986/87 (Table 6). Even taking the differences between surveys in Beaufort Sea State into account (Table 6), these results suggest ($p = 0.0668$) that there were fewer dugongs in this region in 1992 than in 1986/1987. Comparison of the results of the 1986/7 and 1992 surveys (Table 4 and Figures 3b, 4b, and 5), suggests that the decline in dugong numbers was spread throughout much of the region, but was pronounced between Cape Cleveland and Broad Sound (Central Section Blocks 1-7 and Mackay-Capricorn Section Blocks 6-8).

There were indications of local differences in dugong distribution between surveys (Figures 3b and 4b and Table 4) even though there was no significant interaction between block and time (Table 6). For example, in the northern Central Section about 360 dugongs were estimated to be in Block 8 (Cleveland Bay) in both 1986 and 1987 (Marsh and Saalfeld, 1990a) while none was seen in Halifax Bay (Block 9) in 1987. Although the combined dugong population estimate for Blocks 8 and 9 in 1992 was very similar to that for 1987 (Table 4), 70% of the estimated population was in Block 9 in 1992, probably reflecting a dieback in seagrass in eastern Cleveland Bay (unpublished data).

Significance of the Differences between Surveys

As Taylor (1993) has pointed out, no population of marine mammals can be counted in its entirety (a true census). Instead the population is sampled and mathematical techniques are used to estimate the absolute abundance (see Marsh and Sinclair, 1989a and b, Marsh and Saalfeld, 1989). Given the uncertainties of these techniques (especially the correction for animals which are unavailable to observers due to water turbidity), our aerial surveys can best be regarded as providing an index of the distribution and relative abundance of dugongs in the region at the time of the survey. Because we believe that the availability correction factor is conservative (Marsh and Sinclair, 1989a), we consider that our estimates are negatively biased e.g. underestimates of dugong abundance.

In order to maximise the likelihood of detecting trends in dugong abundance (see Gerrodette, 1987; Taylor and Gerrodette, 1993), we have adopted a survey strategy which is designed to make our population estimates as precise as possible. The precision of the dugong population estimates for our entire survey area is very good compared with the corresponding values for other surveys of marine mammals (i.e. the coefficient of variation (CV) for the 1986/7 survey was 0.13; that for the 1992 survey 0.16; the corresponding figures for 18 other species of marine mammals ranged from 0.275 to 1.1, Taylor, 1993). However, because the precision of a population estimate depends strongly on population size (Taylor and Gerrodette (1993)), the precision of the population estimates is much less satisfactory at the local (block) level (see Table 4) and thus our power to

detect trends at the local level is weak. This makes it difficult to interpret apparent trends at a regional level such as the one we have observed.

The observed difference between the estimated densities of dugongs in the entire survey region in 1986/7 and 1992 may have resulted from:

- a genuine decline resulting from mortality or emigration;
- local changes between surveys in the spatial distribution of dugongs especially in areas of low density (see Figures 3b and 4b);
- the difference between surveys in the bias, especially the availability bias, due to minor changes in survey conditions within the acceptable range.

We attempted to compensate for changes in the bias by using survey specific correction factors for perception and availability bias and by using the modal Beaufort Sea State for each transect as a covariate in the analyses. The last increased the probability of there being no significant difference between the 1986/87 and 1992 surveys from 0.003 to 0.0668 but the probability remained disturbingly low (Table 6).

If the change in dugong density between surveys were due solely to a change in the bias, we would expect similar trends in the estimates of density of sea turtles and dolphins. These trends were not observed (see Tables 8, 9, 12, 13 and Figures 6b, 7b, 9, 10b, 11b, 13). We conclude then that there is a strong likelihood that there has been a genuine decline in dugong numbers in the survey area. This is unlikely to be due to emigration either south or north of the survey area. Emigration to the north of our survey area would presumably have been inhibited by the low availability of habitat between Dunk Island and Cape Bedford. In addition, there was a massive dieback of seagrasses accompanied by a high level of dugong mortality in Hervey Bay just outside of the southern boundary of the Great Barrier Reef Marine Park (Preen *et al.,* 1992).

Impacts

Although few dugongs occur in the Great Barrier Marine Park south of Cape Bedford, direct and indirect impacts on dugongs and their habitat from human use appear high. There have been several anecdotal reports suggesting that seagrass is being lost from this region coincident with recent rapid coastal development, although no diebacks of the magnitude reported from Hervey Bay (Preen *et al.* 1993) have been observed. Of the meadows known to support dugongs, 27% are within 5 km of a development or a waste outlet (Morissette, 1992). Only meadows north of Cairns and in Bowling Green, Upstart and Shoalwater Bays are relatively free from anthropogenic impacts.

The effects of trawling on dugong habitats is considered minimal in the southern GBR as it does not occur near major seagrass beds in the region (Morissette, 1992). Dugong mortality resulting from the operations of commercial gill netters

is unquantified. Twenty-five dugongs died in shark nets in the region from 1989 to 1993 (Queensland Boating and Fisheries Patrol, *pers. comm.*). However, there is a recent (but unverified) claim based on anecdotal observations that an average of one dugong per day has been accidentally captured in commercial gill-nets in Shoalwater Bay (Jim Edwards, *pers. comm.*).

There are no data on the magnitude or spatial distribution of the historical or current traditional take of dugongs in this region. Over the last 2.5 years, 70 permits have been issued to allow for traditional hunting of a total of approximately 87 dugongs between Cape Bedford and the southern boundary of the Great Barrier Reef Marine Park. Most permits were issued for hunting between Batt Reef and Mission Beach, Cape Cleveland and Upstart Bay and Midge Point and Clairview. No data are collected on the numbers of dugongs captured under these permits but, if the number taken approached the number for which permits are issued, the take will almost certainly be unsustainable.

The current protection of dugong habitats in the southern region of the GBR is relatively weak compared with the northern region of the marine park. Although 72% of the known seagrass meadows in the region are protected by either Queensland Marine Parks, the Great Barrier Reef Marine Park Authority or Queensland Fisheries Habitat Reserves (Morissette, 1992), 38% of the meadows where dugongs were sighted are not protected from habitat damage. Most of these lie outside of a Marine Park Reserve or within General Use A zones. Only 4% of the habitats where dugongs are known to occur have a protection of greater than General Use B (Figures 3c and 4c). Results of a Log Linear Chi-Squared test indicate that the likelihood of areas where dugongs have been sighted on aerial surveys being protected by zoning in the Great Barrier Reef Marine Park is dependent on the region of the sighting ($p < 0.0001$). A dugong sighted north of Cape Bedford was *11 times* more likely to be in a zone of high protection (greater than General Use B) than a dugong in the southern region of the Park.

Evaluation of the Status of the Dugong in the Southern GBRMP

Comparison of the results of the 1986/7 and 1992 surveys suggests that dugong numbers are declining in the Mackay-Capricorn and Central Sections of the Great Barrier Reef Marine Park. This apparent trend needs to be investigated further by conducting an additional survey as soon as possible, preferably in November 1994. It would also be useful to conduct bimonthly surveys in the region between Townsville and Hinchinbrook in conjunction with the Queensland Department of Environment and Heritage to investigate differences between surveys at the local level. In addition, the surveys of inshore seagrass beds conducted in the region by the Northern Fisheries Research Centre (Lee Long *et al.*, 1993) should be repeated as soon as possible to evaluate the extent of any habitat loss.

TURTLES

Results and Discussion

The six species of sea turtles known to occur in the southern regions of the Great Barrier Reef include the loggerhead (*Caretta caretta*), green (*Chelonia mydas)*, hawksbill (*Eretmochelys imbricata*), flatback (*Natator (Chelonia) depressus*), Pacific Ridley (*Lepidochelys olivacea*) and the leatherback (*Dermochelys coriacea*) (Limpus and Parmenter, 1986). Of these, the leatherback and Pacific Ridley are quite rare, while greens and hawksbill are the most common. Most of the turtles sighted during the 1992 survey were probably large green turtles.

Distribution

Figures 6a, 7a and 8a are maps of the turtle densities in the inshore waters of the Mackay-Capricorn, Central and Cairns Sections respectively of the Great Barrier Reef Marine Park based on the results of the 1992 surveys. Details of actual sightings are given in Appendix Figures 7 through 12. Turtles were sighted at fairly low densities along most of the coast and on the midshelf reefs in the Cairns Section. The densities were lower than those observed using the same technique in the northern regions of the Great Barrier Reef, Torres Strait and Mornington Island in the Gulf of Carpentaria but higher than in south-east Queensland (Table 7). This may be due at least in part, to the fact that the surveys were timed at the beginning of the nesting season. At this time large numbers of turtles congregate near nesting beaches near Raine Island in the Northern Great Barrier Reef and in the Capricorn Bunker Group, resulting in higher densities in these regions and reduced densites in the region of the current survey.

Estimates of Abundance

The values of the mean group size and correction factors used in obtaining the population estimates are summarised in Table 8. Appendix Tables 6, 7 and 8 list the raw data and positions of actual sightings. The estimates of density and numbers of turtles per block surveyed are given in Table 9. The minimum population estimate for the 1992 survey sums to 33291 ± s.e. 5182 turtles for the entire region at an overall density of 0.85 ± 0.13 turtles per km^2. This compares with a minimum population estimate of 26393 ± s.e. 1515 turtles at an overall density of 0.64 ± s.e. 0.04 turtles per km^2 in 1987.

Both with and without the inclusion of Beaufort Sea State as a covariate, there was a significant interaction between block and time (Table 10) suggesting a change in the distribution of sea turtles between surveys (Figures 6b, 7b, 8b). The largest change in density was in Block 15 (near Cooktown) in the Cairns Section (Figure 9).

Evaluation of Survey Results

In calm seas and in clear water, sea turtles (especially the large animals) are easily seen from the air during the low-level surveys. However, with the exception of the leatherback, it is difficult for non-specialist observers to identify turtles to species level and we are unable to confirm the identity of the turtles sighted.

Aerial censuses of turtles present several major difficulties in addition to the problem of species identification. The results of the surveys are likely to be gross underestimates of the true populations. For instance, even neonatal dugongs are large enough to see from the air when flying at the survey height (Marsh and Sinclair, 1989b), but an unknown and variable proportion of turtles is too small to be visible from that height. Parmenter (in Limpus and Parmenter, 1986) found that coral reef habitats in eastern Torres Strait support green turtles as small as 40cm curved carapace length (C.C.L.). Most (79%) were immature (i.e. less than 91 C.C.L.).

In addition, Marsh and Sinclair (1989b) showed that, in contrast to dugongs, the observed density of turtles depends on the sea state even over a small range of conditions; fewer turtles are seen in rougher seas. Sightability may also be a function of wind direction, as this has substantial effects on the turbidity in inshore bays. The status of the tide may also be a factor due to its effect on turtle feeding behaviour. In some areas turtles move into mangrove areas (where they would be less sightable) to feed at high tide and then move back to the seagrass meadows as the tide falls (C.J. Limpus *pers. com.*).

The observed differences between the 1986/87 and 1992 surveys can be explained by:

- the sensitivity of turtle sightings to small changes in sighting conditions that have not been removed from the analysis;

and

- the tendency of turtles to migrate to breed coincident with the timing of the surveys.

Aerial surveys such as these are not suitable for detecting other than gross trends in turtle numbers over long periods of time. Their main value is the resultant density distribution maps (Figures 6, 7, 8) which should be used as an aid in the development of management plans. When these are used it should also be considered that the survey was designed around known dugong distributions. Thus offshore reefs, which may be a significant habitat for turtles, have been omitted from the survey area.

DOLPHINS

Results and Discussion

All cetaceans sighted during the aerial surveys were dolphins. Although observers were often unable to identify dolphins to the species, most of the animals sighted appeared to be the bottlenose dolphin (*Tursiops truncatus*) and the Indo-Pacific hump-back dolphin (*Sousa chinensis*). We made no confirmed sightings of Irrawaddy River dolphins (*Orcaella brevirostris*) despite their occurrence in the survey area.

Distribution and Abundance

Figures 10a, 11a and 12a are maps of dolphin densities based on the results of the 1992 surveys in the Mackay-Capricorn, Central and Cairns Sections of the Park respectively. Actual sightings are mapped in Appendix Figures 13 through 18. The maps indicate that dolphins were dispersed throughout the survey area.

The values of the mean group sizes and correction factors used in obtaining the population estimates are summarised in Table 11. The raw data have been listed in Appendix Tables 9, 10 and 11. The estimates of density and numbers of dolphins per block surveyed are given in Table 12 for comparison with the results of the corresponding surveys in 1986/87.

On the basis of the 1992 survey, we estimated an overall minimum population of 11,928 ± s.e. 1505 dolphins for the whole region at an overall density of 0.30 ± 0.04 dolphins km^{-2}. The corresponding population estimates for 1986/87 were 6,743 ± s.e. 542 dolphins at an overall density of 0.17 ± s.e. 0.01 dolphins km^{-2}. These numbers are underestimates of the numbers of dolphins actually present as we made no correction for availability bias and probably undercounted groups of dolphins as we did not interrupt the transect to circle dolphin groups as this was a survey designed primarily for dugongs.

In 1992, the highest densities of dolphins were observed in Blocks 1 and 7 of the Mackay/Capricorn Section, Block 1 (Central Section) and Block 13 (Cairns Section) (Table 12). Block 1 (Mackay/Capricorn Section) supported the highest density of dolphins in 1986/1987. The dolphins in that area tend to occur in small groups of less than 10 and those identified were mainly *T. truncatus*.

Irrespective of whether or not Beaufort Sea State was used as a covariate in the analyses, there was no significant difference in dolphin density between the two sampling times nor was there any significant interaction between block and time (Table 13, Figures 10b, 11b and 12b) suggesting that the dolphins were dispersed similarly during the two surveys. The largest change in density was in Block 7 in the Mackay/Capricorn Section.

Conclusion

The dolphin density observed for the whole region in 1992 was the highest ever recorded using this aerial survey technique (Table 14) suggesting that the inshore waters of the southern half of the Great Barrier Reef Marine Park are important for dolphins. However, we do not recommend the funding of dedicated aerial surveys of dolphins in the Great Barrier Reef Marine Park at present as there is no evidence that dolphins present a management problem in this area. These results provide a baseline for future monitoring of dolphins on dugong surveys. As with the turtles it should be kept in mind that this survey was designed specifically to survey dugongs and thus there is a bias toward dugong habitats, to the exclusion of offshore reefs which may be important dolphin habitats.

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Table 1: Weather conditions encountered during the surveys in 1986/87 and 1992. Values for Beaufort sea state and glare are the mean of the modes for each transect with range in parentheses. Glare is measured as: 0, none; 1, <25% of the field affected; 2, 25-50%; 3, >50%.

	1986/87	1992
Wind speed (km/hr)	<37	<37
Cloud cover (oktas)	0-4	0-5
Minimum cloud height (m)	300	2500
Beaufort sea state	1.0(0-3.0)	1.0(0-4.0)
Glare	1.0,2.0(0-3.0)	2.0(0-3.0)
Visibility (km)	>20	N/A

Table 2: Areas of survey blocks and sampling intensities for the 1992 survey. See Figures 1a, b and c for block numbers.

Block	Area (km²)	Sampling %
Mackay/Capricorn Section		
1	1391	10.3
2	895	9.6
3	1022	14.7
4	3274	7.5
5	1105	19.5
6	6016	8.9
7	1612	9.7
8	775	14.3
Southern Central Section		
1	297	21.4
2	644	9.5
3	1901	9.8
4	448	17
5	2230	8.1
6	218	17.8
7	560	15.9
Northern Central Section		
8	612	17.6
9	3845	8.7
10	310	18.3
11	714	16.1
Cairns Section		
12	3800	8.5
13	2013	8.3
14	4786	9.4
15	715	8.7

TABLE 3: Details of group size estimates and correction factors used in the population estimates for dugongs.

BLOCKS	GROUP SIZE mean (cv)*	NUMBER OF OBSERVERS		PERCEPTION CORRECTION FACTOR ESTIMATES (cv)		AVAILABILITY CORRECTION FACTOR
		PORT	STARBOARD	PORT	STARBOARD	ESTIMATE (cv)
S** 1,2,3,4,5,6, C*** 1,2,3,4	1.4091 (0.1028)	2	2	1.1876 (0.0452)	1.0408 (0.0126)	2.0516 (0.1511)
C 5,6	1.4444 (0.0444)	1****	1*****	1.4286 (0.0791)	1.1667 (0.0445)	2.7692 (0.2008)
C 7,8	1.4444 (0.0444)	2	1	1.1607 (0.0791)	1.1667 (0.0445)	2.7692 (0.2008)
C 9,10,11, 12,13,14,15	1.4444 (0.0444)	2	2	1.1607 (0.0791)	1.0606 (0.0444)	2.7692 (0.2008)

* Coefficient of variation
** S = Mackay/Capricorn Section
*** C = Central Section and Cairns Section
**** Port correction factors based on port mid-seat observer.
***** Starboard correction factors based on starboard mid-seat observer.

TABLE 4: Comparison of the number of dugongs on the surveys conducted in 1986,1987 and 1992. The values are ± standard errors.

Block	Densities		Numbers	
	1986/1987	1992	1986/1987	1992
Mackay/Capricorn Section (Figure 1a)				
1	0.03 ± 0.03	0.09 ± 0.05	48 ± 46	122 ± 71
2	0	0.11 ± 0.06	0	94 ± 50
3	0.29 ± 0.09	0.09 ± 0.06	301 ± 95	91 ± 60
4	0.02 ± 0.01	0.01 ± 0.01	51 ± 48	42 ± 40
5	0.69 ± 0.15	0.51 ± 0.17	765 ± 161	566 ± 185
6	0.09 ± 0.05	0.01 ± 0.01	542 ± 293	34 ± 33
7	0	0	0	0
8	0.31 ± 0.13	0.03 ± 0.03	240 ± 104	24 ± 22
Southern Central Section (Figure 1b)				
1	0.10 ± 0.12	0.24 ± 0.20	31 ± 35	70 ± 59
2	0.10 ± 0.11	0	65 ± 69	0
3	0	0.02 ± 0.01	0	35 ± 27
4	0.39 ± 0.17	0.09 ± 0.05	173 ± 77	40 ± 24
5	0.14 ± 0.05	0	312 ± 122	0
6	0.79 ± 0.40	0.42 ± 0.21	171 ± 87	91 ± 46
7	0.24 ± 0.21	0.10 ± 0.09	136 ± 120	58 ± 50
Northern Central Section (Figure 1b)				
8	0.59 ± 0.15	0.17 ± 0.09	360 ± 92	106 ± 56
9	0	0.07 ± 0.03	0	257 ± 105
10	0.59 ± 0.35	0.46 ± 0.29	184 ± 110	141 ± 89
11	0.14 ± 0.10	0.12 ± 0.16	100 ± 71	86 ± 72
Cairns Region (Figure 1c)			not enough to estimate	
TOTAL	0.09 ± 0.01	0.05 ± 0.007	3479 ± 459	1857 ± 292
Precision			0.13	0.16

Table 5: Numbers and densities of dugongs in the southern Great Barrier Reef region relative to other areas surveyed using the same technique.

Location	Date	Area	Population Estimate ± S.E.	Density . km^{-1}	Reference
Shark Bay, WA	Jul-1989	14240	10146 ± 1478	0.71 ± 0.10	Marsh et al., 1991
Exmouth Gulf - Ningaloo, WA	Jul-1989	3387	1964 ± 363	0.58 ± 0.11	Marsh et al., unpub.
Northern Coast Northern Territory	Dec-1983	28746	13800 ± 2683	0.48 ± 0.09	Bayliss, 1986; Bayliss & Freeland 1989
Western Gulf of Carpentaria	Aug-1984	27216	16816 ± 2946	-	Bayliss & Freeland, 1989
	Feb-1985	27216	16846 ± 3259	0.62 ± 0.12	Bayliss & Freeland, 1989
Mornington Island area	Dec-1991	8848	4067 ± 723	.46 ± 0.0	Marsh & Lawler, 1992b
Torres Strait	Nov-1987	30533	12522 ± 1487	.41 ± 0.0	Marsh & Saalfeld, 1991
	Nov-Dec 1991	30533	24225 ± 3276	.79 ± 0.1	Marsh & Lawler, 1992a
Northern Great Barrier Reef	Nov-1985	31288	8110 ± 1073	.26 ± 0.0	Marsh & Saalfeld, 1989a
	Nov-Dec 1990	31288	10471 ± 1578	.33 ± 0.0	Marsh et al, 1993
Southern Great Barrier Reef	Nov-1986 Sept-Oct 1987	39396	3479 ± 459	.09 ± 0.0	Marsh & Saalfeld, 1990a
	Nov-Dec 1992	39396	1857 ± 292	.05 ± 0.0	**this study**
South-east Queensland	Jul-Aug 1988	9170	2479 ± 365	.26 ± 0.0	Marsh Saalfeld & Preen, 1990
Hervey Bay	Jul-Aug 1988	4593	1971 ± 359	.42 ± 0.16	Marsh Saalfeld & Preen, 1990
Moreton Bay	Jul 1988 - Feb 1990	1843	600		Preen, 1992

TABLE 6: Summary of analysis of variance comparing observed dugong density in the southern GBR in 1986/87 and 1992. (1) Without covariates (2) With Beaufort sea state as a covariate. Data were transformed by log(x + 1).

Sources of	DF		F		Significance of F	
variation	1	2	1	2	1	2
Blocks**	18	18	8.96	2.98	0.0001	0.0001
Time*	1	1	8.97	3.39	0.003	0.0668
Transect nested in Block*	292	292	1.57	1.55	0.0001	0.0002
Block by Time*	18	18	1.28	1.47	0.208	0.1029
Residual	292	291				
Regression*		1		0.07		0.7857

* Tested against Residual

** Tested against Transect nested in Block

Table 7: Densities of turtles in the southern Great Barrier Reef region relative to other areas surveyed using the same technique

Location	Date	Area	Density . km-¹	Reference
Mornington Island area	Dec-1991	8848	0.95 ± 0.1	Marsh & Lawler, 1992b
Torres Strait	Nov-87	30533	1.43 ± 0.1	Marsh & Saalfeld 1991
	Nov-Dec 1991	30533	2.13 ± 0.17	Marsh & Lawler, 1992a
Northern Great Barrier Reef	Nov-1985	31288	1.03 ± 0.0	Marsh & Saalfeld, 1989b
	Nov-Dec 1990	31288	1.46 ± 0.1	Marsh et al, 1993
Southern Great Barrier Reef	Nov-Dec 1986/1987	39396	0.64 ± 0.04	**this study**
	Nov-Dec 1992	39396	0.85 ± 0.31	**this study**
South-east Queensland	Nov-1986 Sept-Oct 1987	39396	0.32 ± 0.0	Marsh & Saalfeld, 1990a

TABLE 8: Details of group size estimates and correction factors used in the population estimates for turtles.

BLOCKS	GROUP SIZE mean (cv)*	NUMBER OF OBSERVERS		PERCEPTION CORRECTION FACTOR ESTIMATES (cv)		AVAILABILITY CORRECTION FACTOR ESTIMATE (cv)
		PORT	STARBOARD	PORT	STARBOARD	
S** 1,2,3,4,5,6, C*** 1,2,3,4	1.1580 (0.0320)	2	2	1.1635 (0.0162)	1.0602 (0.0065)	2.4592 (0.0704)
C 5,6	1.6059 (0.2105)	1****	1*****	1.4234 (0.0169)	1.1462 (0.0097)	1.3214 (0.0844)
C 7,8	1.6059 (0.2105)	2	1	1.1338 (0.0169)	1.1462 (0.0097)	1.3214 (0.0844)
C 9,10,11, 12,13,14,15	1.6059 (0.2105)	2	2	1.1338 (0.0169)	1.0576 (0.0097)	1.3214 (0.0844)

* Coefficient of variation
** S = Mackay/Capricorn Section
*** C = Central Section and Cairns Section
**** Port correction factors based on port mid-seat observer.
***** Starboard correction factors based on starboard mid-seat observer.

TABLE 9: Comparison of the number of turtles on the surveys conducted in 1986/1987 and 1992. The values are ± standard errors.

Block	Densities		Numbers	
	1986/1987	1992	1986/1987	1992
Mackay/Capricorn Section (Figure 1a)				
1	0.26 ± 0.09	0.67 ± 0.19	368 ± 126	929 ± 262
2	0.68 ± 0.17	0.70 ± 0.26	608 ± 153	628 ± 234
3	2.08 ± 0.30	0.96 ± 0.41	2126 ± 303	976 ± 418
4	0.45 ± 0.09	0.18 ± 0.06	1482 ± 293	594 ± 180
5	3.23 ± 0.30	3.52 ± 0.43	3565 ± 330	3888 ± 474
6	0.55 ± 0.13	0.56 ± 0.10	3292 ± 766	3378 ± 602
7	0.26 ± 0.06	0.28 ± 0.05	414 ± 96	459 ± 86
8	2.38 ± 0.83	1.31 ± 0.46	1847 ± 643	1015 ± 353
Southern Central Section (Figure 1b)				
1	0.77 ± 0.36	1.03 ± 0.26	229 ± 106	306 ± 78
2	0.36 ± 0.13	0.26 ± 0.08	423 ± 153	169 ± 52
3	0.51 ± 0.09	0.90 ± 0.18	869 ± 160	1708 ± 350
4	0.54 ± 0.19	1.00 ± 0.16	243 ± 86	450 ± 72
5	0.36 ± 0.09	0.20 ± 0.06	797 ± 195	443 ± 139
6	1.17 ± 0.34	0.73 ± 0.40	256 ± 75	160 ± 87
7	0.35 ± 0.20	0.05 ± 0.03	199 ± 113	30 ± 17
Northern Central Section (Figure 1b)				
8	1.04 ± 0.25	0.70 ± 0.20	636 ± 151	427 ± 120
9	0.19 ± 0.04	0.62 ± 0.12	744 ± 164	2376 ± 463
10	0.43 ± 0.11	1.38 ± 0.31	132 ± 34	429 ± 96
11	0.19 ± 0.06	0.67 ± 0.19	132 ± 42	480 ± 137
Cairns Region (Figure 1c)				
12	0.30 ± 0.06	0.40 ±0.14	1154 ± 240	1521 ± 517
13	0.49 ± 0.12	0.72 ± 0.30	993 ± 249	1453 ± 611
14	1.18 ± 0.17	1.74 ± 0.94	5660 ± 808	8320 ± 4481
15	0.31 ± 0.14	4.41 ± 3.02	224 ± 101	3152 ± 2160
TOTAL	0.64 ± 0.04	0.85 ±0.13	26393 ± 1515	33291 ± 5182
Precision			0.06	0.16

TABLE 10: Summary of analysis of variance comparing observed turtle density in the southern GBR in 1986/87 and 1992. (1) Without covariates (2) With Beaufort sea state as a covariate. Data were transformed by log(x + 1).

Sources of variation	DF		F		Significance of F	
	1	2	1	2	1	2
Blocks**	18	18	32.63	32.06	0.0001	0.0001
Time*	1	1	0.01	1.59	0.9796	0.2078
Transect nested in Block*	289	289	2.24	2.19	0.0001	0.0001
Block by Time*	18	18	3.79	3.14	0.0001	0.0001
Residual	289	288				
Regression*		1		3.51		0.062

* Tested against Residual

** Tested against Transect nested in Block

TABLE 11: Details of group size estimates and correction factors used in the population estimates for dolphins.

BLOCKS	GROUP SIZE mean (cv)*	NUMBER OF OBSERVERS		PERCEPTION CORRECTION FACTOR ESTIMATES (cv)	
		PORT	STARBOARD	PORT	STARBOARD
S** 1,2,3,4,5,6,7, C*** 1,2,3,4	2.9143 (0.2800)	2	2	1.1702 (0.0406)	1.1237 (0.0308)
C 5,6	2.4194(0.2618)	1****	1*****	1.4348 (0.0294)	1.3200 (0.0313)
C 7,8	2.4194(0.2618)	2	1	1.1011 (0.0294)	1.3200 (0.0313)
C 9,10,11, 12,13,14,15	2.4194(0.2618)	2	2	1.1011 (0.0294)	1.1088 (0.0313)

* Coefficient of variation
** S = Mackay/Capricorn Section
*** C = Central Section and Cairns Section
**** Port correction factors based on port mid-seat observer.
***** Starboard correction factors based on starboard mid-seat observer.

TABLE 12: Comparison of the number of dolphins on the surveys conducted in 1986, 1987 and 1992. The values are ± standard errors.

Block	Densities		Numbers	
	1986/1987	1992	1986/1987	1992
Mackay/Capricorn Section (Figure 1a)				
1	0.50 ± 0.12	0.57 ± 0.30	699 ± 164	787 ± 422
2	0.10 ± 0.5	0.04 ± 0.04	87 ± 45	34 ± 35
3	0.13 ± 0.04	0.18 ± 0.10	130 ± 38	183 ± 99
4	0.08 ± 0.02	0.32 ± 0.19	245 ± 75	1052 ± 607
5	0.01 ± 0.01	0.17 ± 0.09	15 ± 9	186 ± 100
6	0.03 ± 0.02	0.02 ± 0.01	205 ± 101	111 ± 81
7	0.11 ± 0.05	1.14 ± 0.42	180 ± 81	1836 ± 682
8	0.37 ± 0.10	0.42 ± 0.25	283 ± 74	328 ± 191
Southern Central Section (Figure 1b)				
1	0.38 ± 0.19	0.64 ± 0.60	113 ± 57	190 ± 178
2	0.21 ± 0.08	0.22 ± 0.13	250 ± 91	141 ± 86
3	0.14 ± 0.05	0.30 ± 0.19	229 ± 91	577 ± 358
4	0.11 ± 0.05	0.13 ± 0.12	48 ± 22	58 ± 52
5	0.22 ± 0.08	0.15 ± 0.07	498 ± 178	341 ± 159
6	0	0.34 ± 0.15	0	73 ± 32
7	0.28 ± 0.31	0.04 ± 0.03	16 ± 18	20 ± 17
Northern Central Section (Figure 1b)				
8	0.19 ± 0.10	0.26 ± 0.13	115 ± 64	161 ± 78
9	0.27 ± 0.06	0.33 ± 0.11	1037 ± 239	1288 ± 428
10	0	0.09 ± 0.07	0	29 ± 20
11	0.30 ± 0.11	0.39 ± 0.14	217 ± 84	279 ± 103
Cairns Section (Figure 1c)				
12	0.17	0.47 ± 0.15	662 ± 197	1789 ± 570
13	0.46	0.77 ± 0.32	927 ± 186	1547 ± 636
14	0.15	0.17 ± 0.05	722 ± 201	798 ± 228
15	0.09	0.22 ± 0.14	65 ± 39	154 ± 98
TOTAL	0.17 ± 0.01	0.30 ± 0.04	6743 ± 542	11928 ± 1505
Precision			0.08	0.13

TABLE 13: Summary of analysis of variance comparing observed dolphin density in the southern GBR in 1986/87 and 1992. (1) Without covariates (2) With Beaufort sea state as a covariate. Data were transformed by log(x + 1).

Sources of	DF		F		Significance of F	
variation	1	2	1	2	1	2
Blocks**	18	18	2.12	3.81	0.006	0.0001
Time*	1	1	2.07	2.54	0.1517	0.1121
Transect nested in Block*	290	290	0.99	0.98	0.5279	0.5771
Block by Time*	18	18	1.3	1.28	0.1896	0.201
Residual	290	289				
Regression*		1		4.86		0.1896

* Tested against Residual

** Tested against Transect nested in Block

Table 14: Densities of dolphins in the southern Great Barrier Reef region relative to other areas surveyed using the same technique

Location	Date	Area	Density . km^{-1}	Reference
Shark Bay, WA	Jul-1989	14240	0.19 ± 0.0	Marsh et al., unpub.
Exmouth Gulf - Ningaloo, WA	Jul-1989	3387	0.16 ± 0.0	Marsh et al., unpub.
Mornington Island area	Dec-1991	8848	0.09 ± 0.0	Marsh & Lawler, 1992b
Torres Strait	Nov-Dec 1991	30533	0.07 ± 0.0	Marsh & Lawler, 1992a
Northern Great Barrier Reef	Nov-1985	31288	0.21 ± 0.0	Marsh, 1990
	Nov-Dec 1990	31288	0.16 ± 0.0	Marsh et al, 1993
Southern Great Barrier Reef	Nov-1986 Sept-Oct 1987	39396	0.18 ± 0.01	Marsh, 1990
	Nov-Dec 1992	39396	0.32 ± 0.04	**this study** .

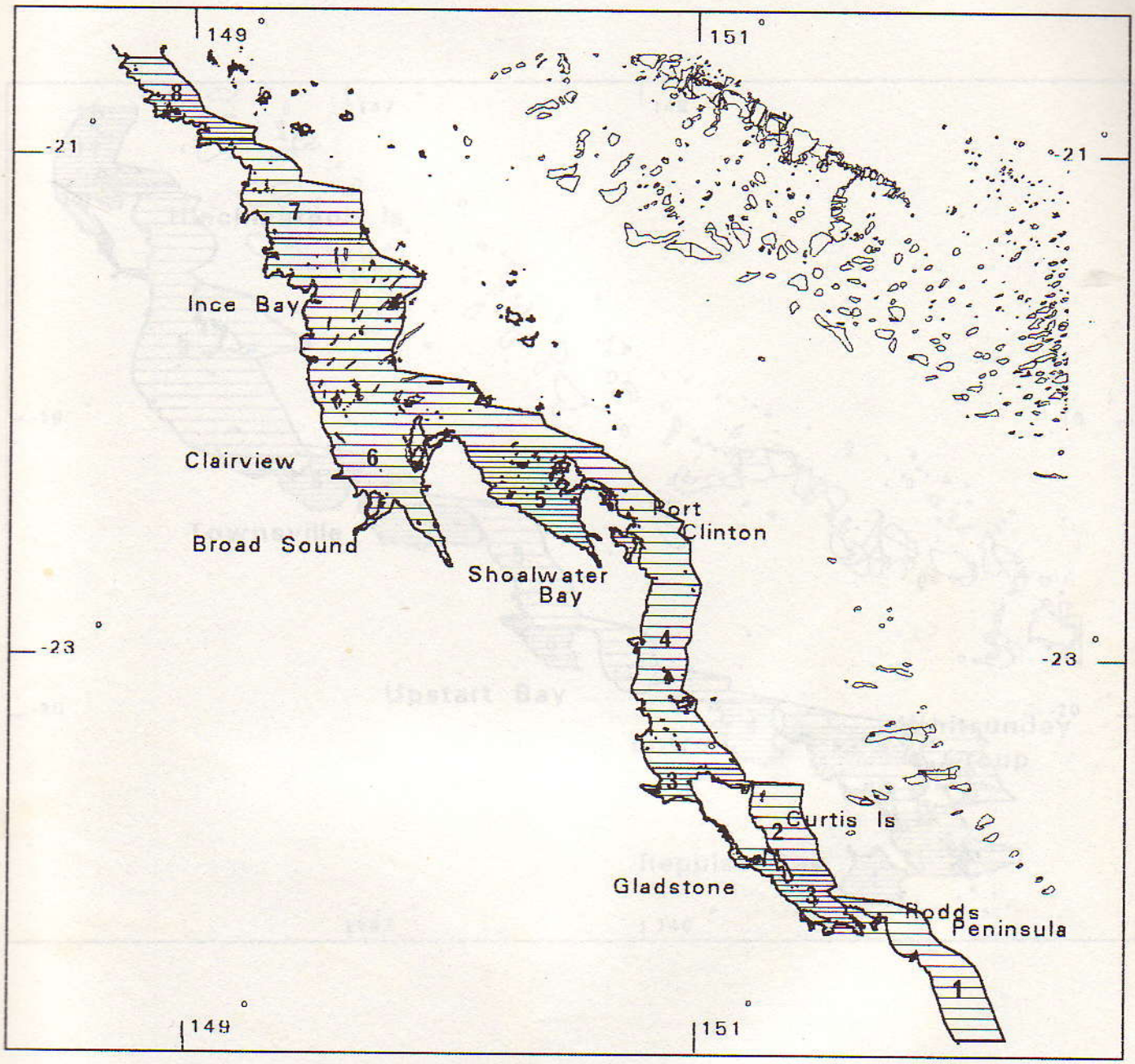


Figure 1a: The transect lines in blocks (1-8) flown in November-December 1992 in the inshore waters of the Mackay-Capricorn Section of the Great Barrier Reef Marine Park.

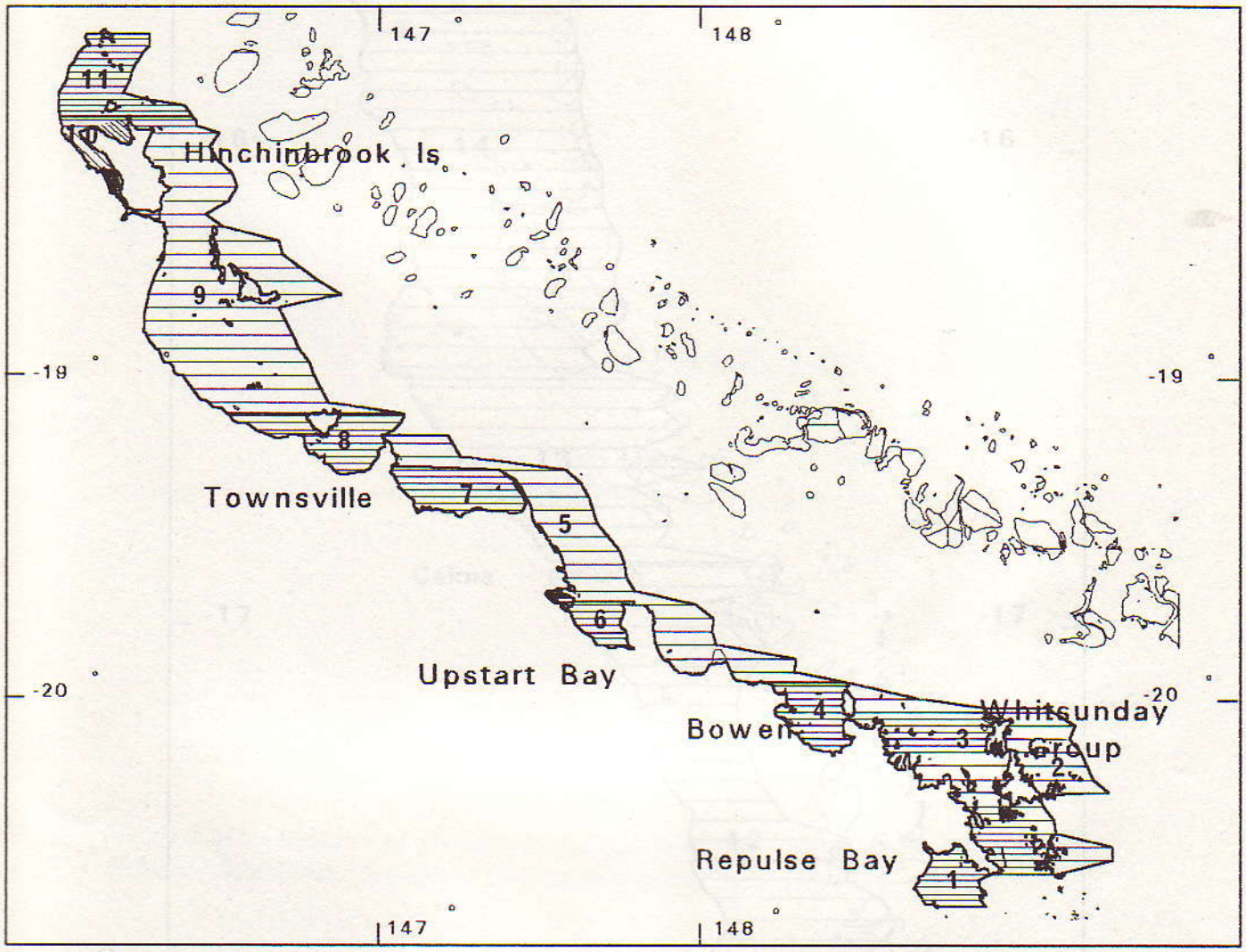


Figure 1b: The transect lines in blocks (1-11) flown in November-December 1992 in the inshore waters of the Central Section of the Great Barrier Reef Marine Park.

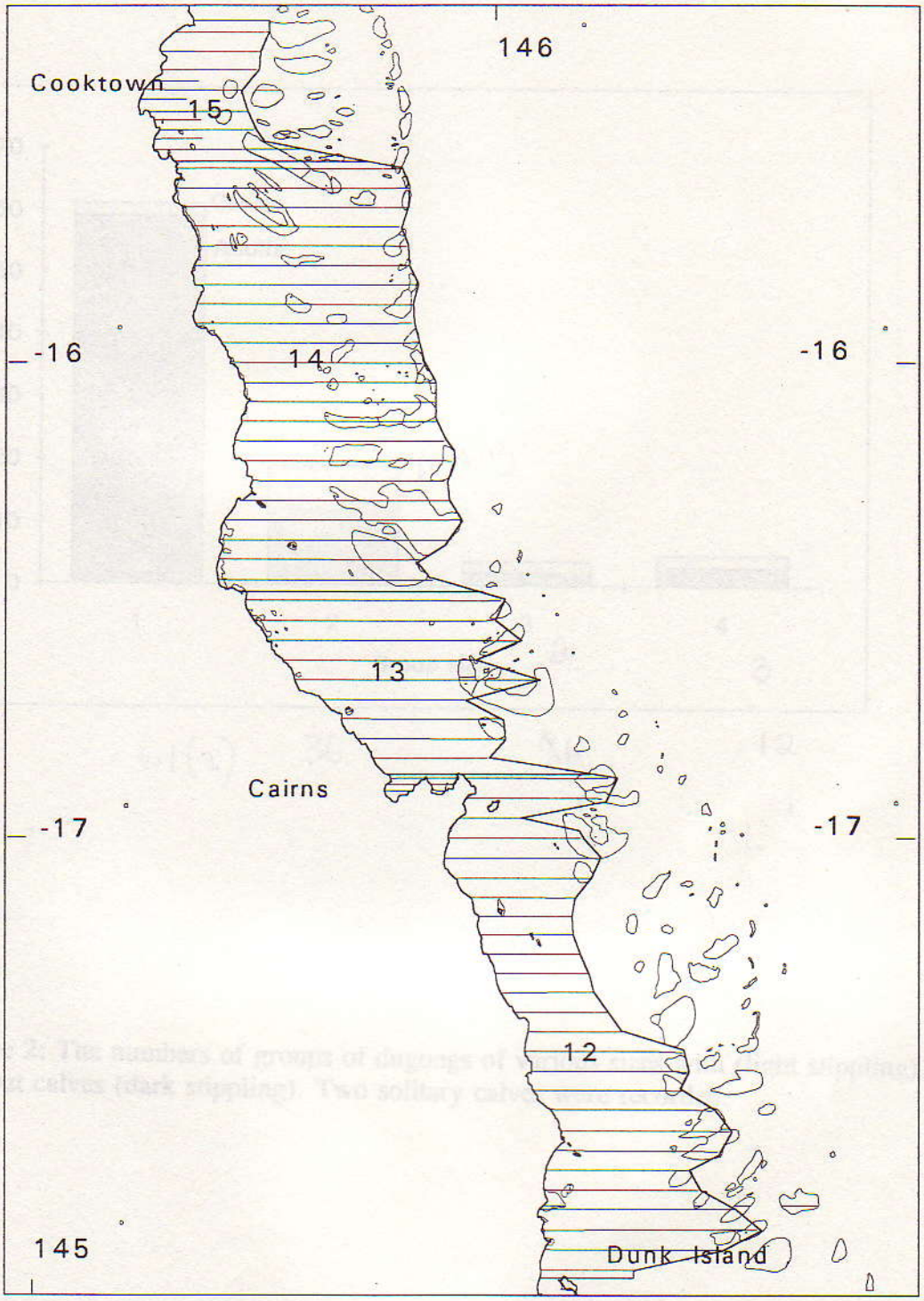


Figure 1c: The transect lines in blocks (12-15) flown in November-December 1992 between Cape Bedford and Dunk Island in inshore waters of the Cairns Section of the Great Barrier Reef Marine Park. Data from the higher intensity transects flown close to Cairns and Cooktown were not used in the population estimates but were used in the estimates of density per cell.

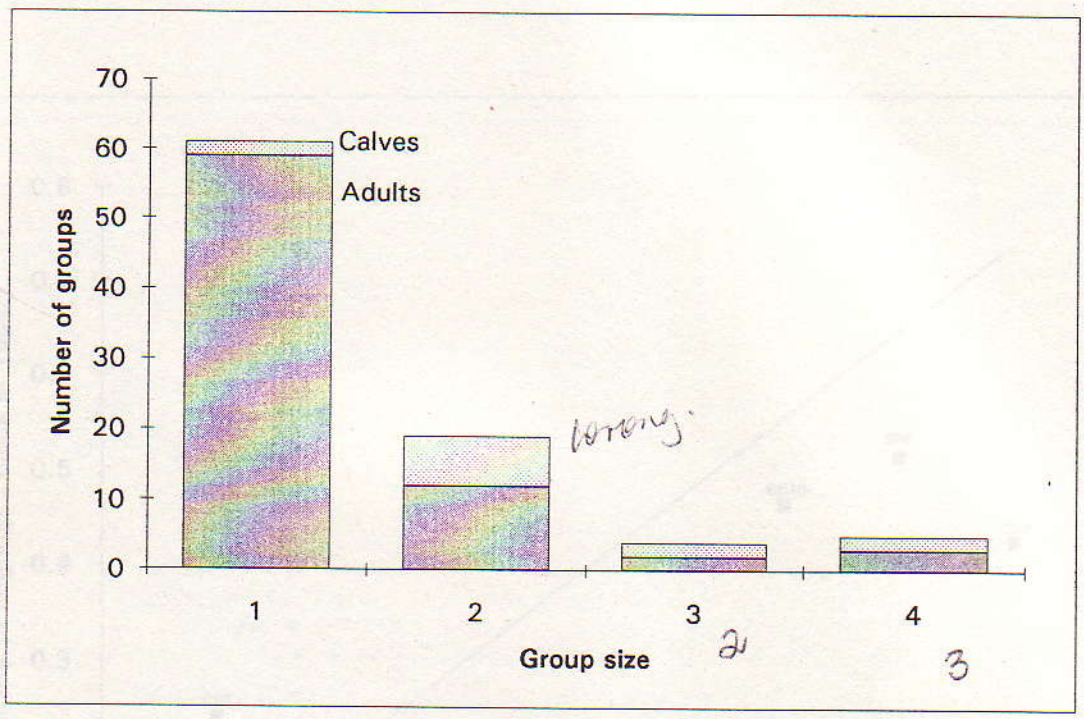


Figure 2: The numbers of groups of dugongs of various sizes with (light stippling) and without calves (dark stippling). Two solitary calves were recorded.

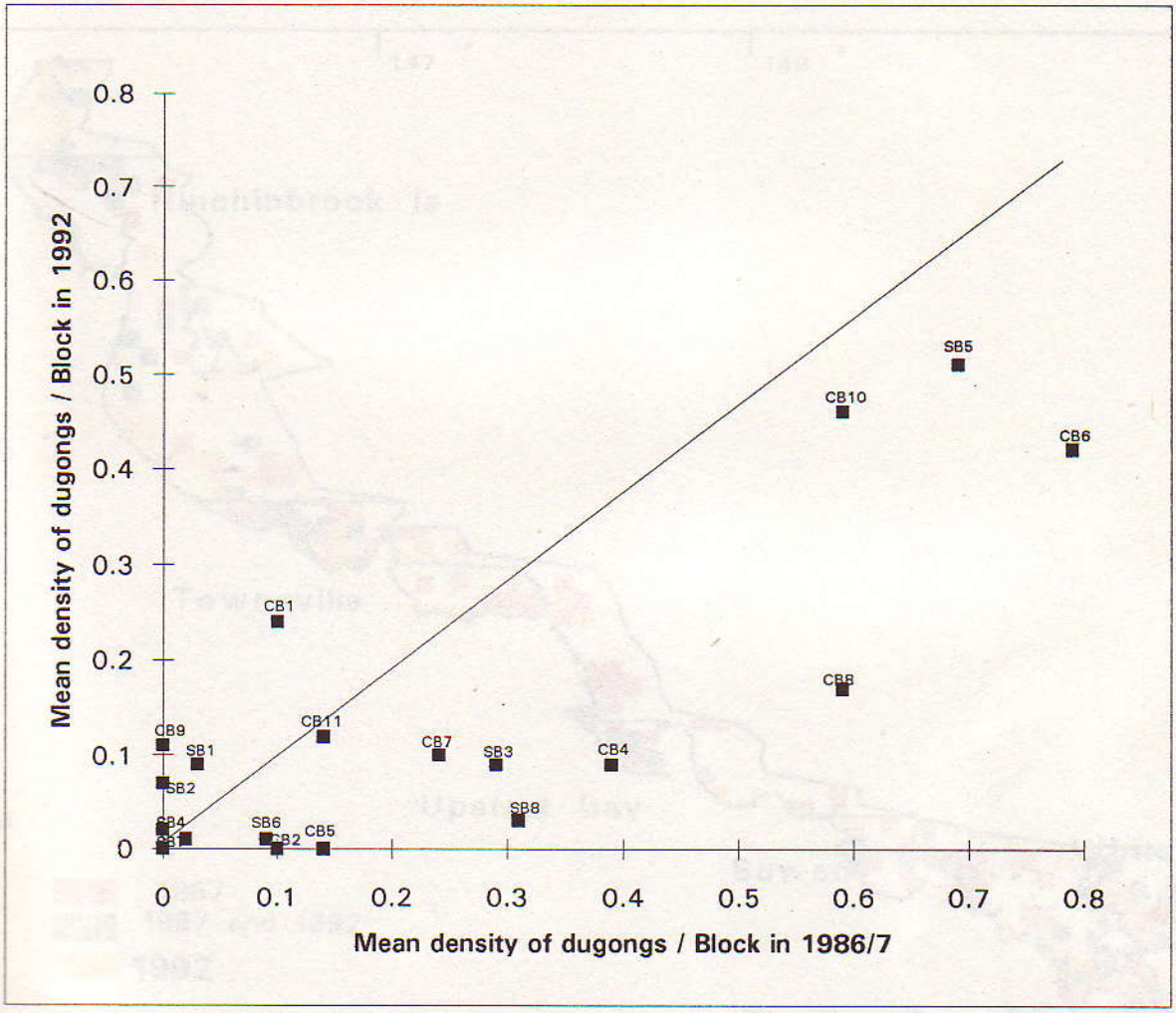


Figure 5. The mean density of dugongs/km² in each block in 1986/7 and 1992. The line represents equal densities on the two surveys. The Blocks labelled S are in the Southern Section (Figure 1a); those labelled C in the Central (Figure 1b) and Cairns Sections (Figure 1c) of the Great Barrier Reef Marine Park.

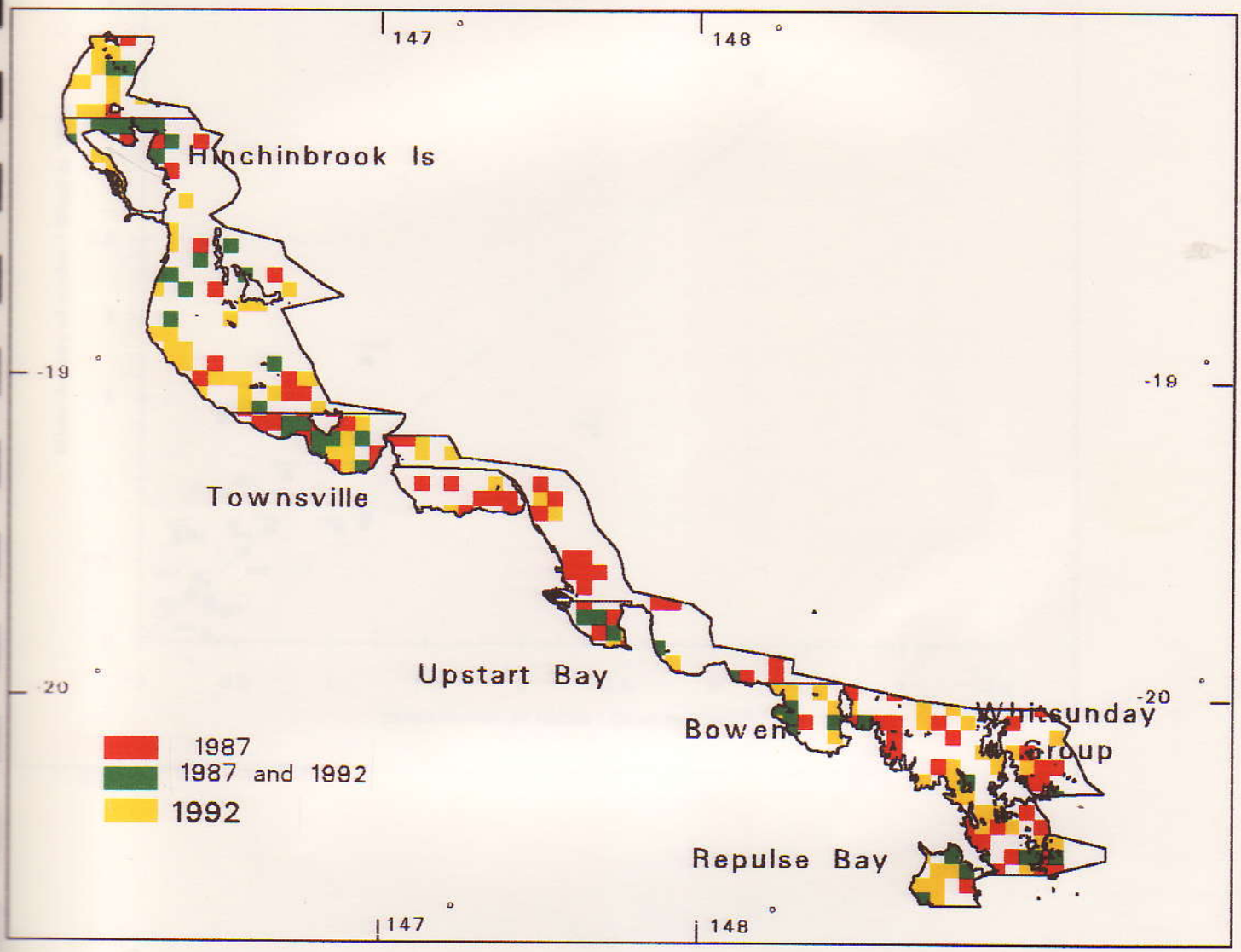


Figure 7b: A comparison of the presence and absence of turtle sightings within a 5 x 5 nm square grid in the inshore waters of the Central Section of the Great Barrier Reef Marine Park in 1987 and 1992. Red areas show where turtles were sighted in 1987 only, yellow areas show where turtles were sighted in 1992 only and green areas show where turtles were sighted during both surveys.

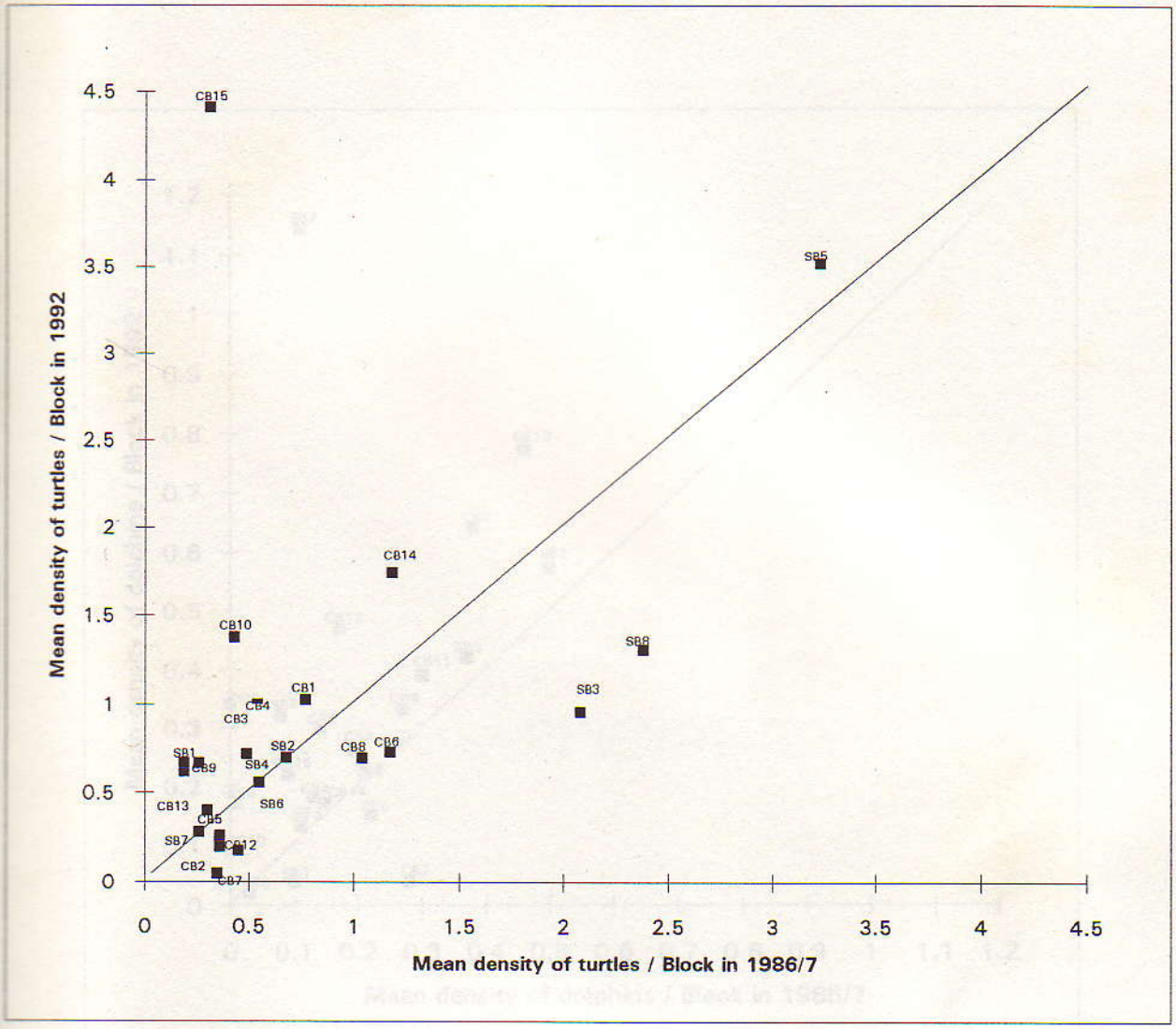


Figure 9. The mean density of turtles/km^2 in each block in 1986/7 and 1992. The line represents equal densities on the two surveys. The Blocks labelled S are in the Southern Section (Figure 1a); those labelled C in the Central (Figure 1b) and Cairns Sections (Figure 1c) of the Great Barrier Reef Marine Park.

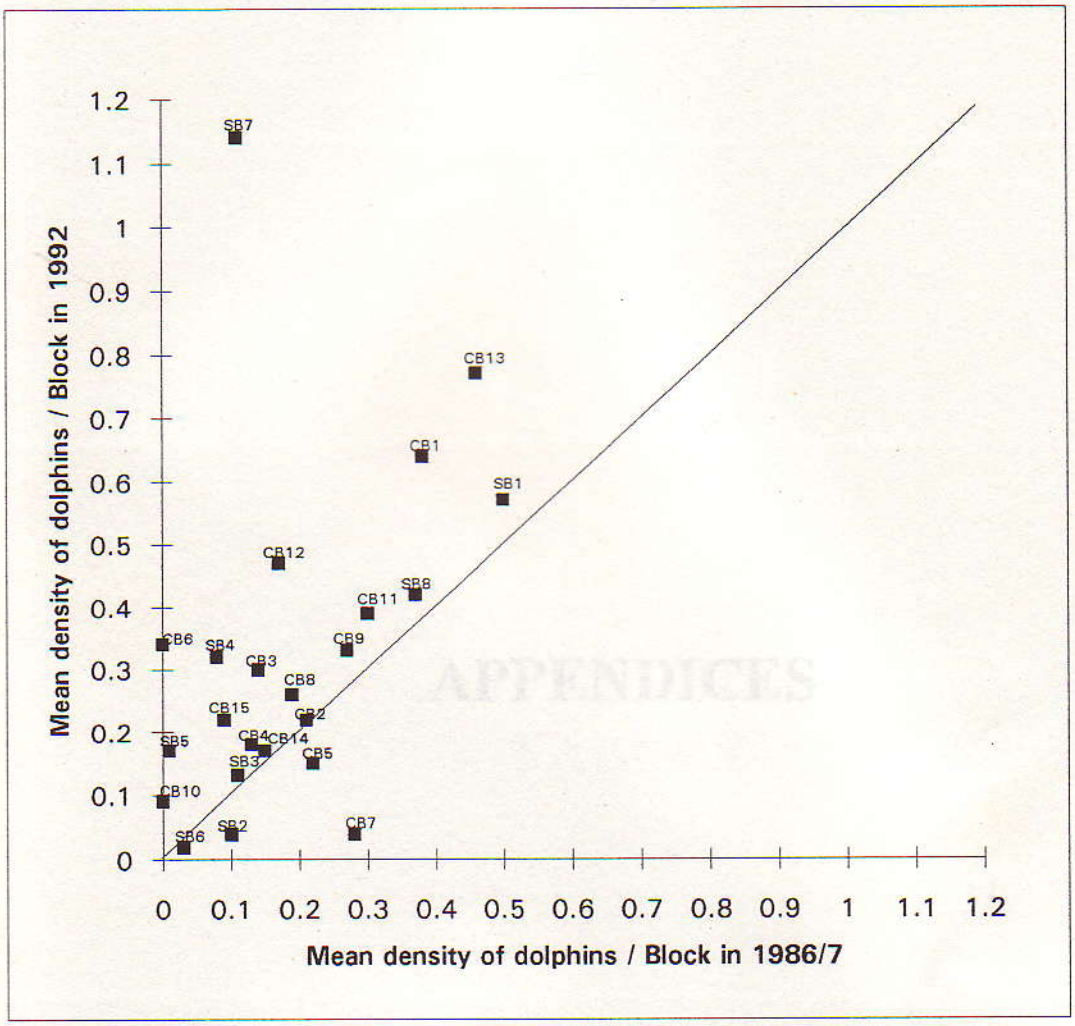


Figure 13. The mean density of dolphins/km_2 in each block in 1986/7 and 1992. The line represents equal densities on the two surveys. The Blocks labelled S are in the Southern Section (Figure 1a); those labelled C in the Central (Figure 1b) and Cairns Sections (Figure 1c) of the Great Barrier Reef Marine Park.

APPENDIX
TABLES

Table 1: Beaufort Sea State and glare (for the north/east and south/west sides of the aircraft) for each transect. The location of transects is indicated on Appendix Figures 1-18.

Scale : 0 = no glare
1 = 0 < 25% field of view glare affected
2 = 25 < 50% field of view glare affected
3 = > 50% field of view glare affected

Transect No.	Beaufort Sea State mode(range)	Glare	
		North mode(range)	South mode(range)
Blocks 1- 3, Mackay Capricorn Section			
1	2.5	2.5	2
2	3(2-3)	3	2-2.5
3	2.5-3	2	2.5
4	2-2.5	2.5-3	2
5	3	2	2
6	3	3	2-2.5
7	3	2-2.5	2-2.5
8	3	3	2
9	2.5-3	2	2
10	3	3	2.5
11	3	2.5	2.5
12	3	3	2.5
13	3	3	2.5
14	3	2.5	3
15	2(2-3)	3	3
16	1.5-2.5	2	1.5
17	1-2.5	0.5-2	2(1.5-2)
18	2	2	2(2-2.5)
19	1(1-2)	1-2.5	2
20	3	2.5	2.5
21	3	3	2
22	3	3	2-3
23	3	3	2
24	3	2.5	2
25	1.5-3	1.5-3	2
26	2.5	2.5	2
27	3	2	2
28	2	1.5	1
29	3	2	2
271	2.5-3	2	1.5
12a	1.5	2	2
13a	2.5	2	2
14a	3	2	2
15a	2.5-3	2	2-2.5
16a	1	2	1
17a	1	1	1
18a	2	3	1.5
25a	3	2.5	2
28a	3	2	1.5

Transect No.	Beaufort Sea State mode(range)	Glare	
		North mode(range)	South mode(range)
Blocks4-5, Mackay Capricorn Section			
30	2.5-3	2	2
31	2.5-3	2-3	1.5-2
32	2.5(2.5-3)	2	2-2.5
33	2.5-3	2-3	2-2.5
34	2.5-3	2	2-2.5
35	2.5-3	3	2.5
36	2.5	2	2
37	2.5-3	2.5	2
38	3(2.5-3)	2	2-2.5
39	2.5	2	3
40	1.5	2	2
41	1	1.5	1
42	1.5	2	2
43	1.5	1	1
44	1.5	2	2
45	1.5	1	1
46	1.5	2	2
47	1.5	1.5	2
48	3	2	2
49	2.5-3	2	2
50	1	2	2
50	3	1	1
51	1.5	2	1.5-2
51	3	2	1.5
52	2.5(1.5-2.5)	2	1-2
52	1.5-2.5	2	2
53	2.5	2	2
54	2.5	2	2
55	2.5-3	2.5	2.5
56	2.5(1.5-2.5)	1-2	2
59	2(1-2.5)	2	2
60	2-2.5	2	1.5
61	2	2	2
62	3(2-3)	2.5	2.5
63	2.5-3	2	2.5
64	1.5-2.5	2-2.5	2-2.5
65	2.5(2.5-3)	2	2
66	2.5(2-3)	2.5	2.5
67	3(1-3)	2	2
68	2(2-3)	2.5	2.5
69	2(1-2.5)	1(1-2)	2
70	2-2.5	2.5	2
71	2.5(2-2.5)	2-2.5	2.5
72	2.5(1-2.5)	1.5-2	2
73	2.5(2.5-3)	1.5-2	2.5
74	1.5-2.5	2(1-2)	2.5(2-2.5)
75	2.5(2.5-3)	2(1-2.5)	2.5
55a	1	2	2
56a		2	2
59c	2.5	1	1
60c	2	2	1.5

Transect No.	Beaufort Sea State mode(range)	Glare	
		North mode(range)	South mode(range)
Blocks 6-8, Mackay Capricorn Section			
77	1	2	2
78	1	1	1
79	1	1	1
80	1	1	1
81	2	1	2
82	1.5(1.5-2)	1	2
83	1.5	1	2
84	1.5	1	2
85	1-2.5	1	2
86	1.5-2	1	1.5
87	1.5-2	2	2(2-2.5)
88	1-2.5	1-2	2
89	2.5(1.5-3)	2	2
90	2(2-2.5)	2	2-2.5
91	2-2.5	2	1.5
92	2-3	2.5	2.5
93	2-3	1.5-2	1.5-2
94	2(2-3)	1.5-2	2.5
95	2	2	2-2.5
96	1.5	1	1
97	1.5	1.5	2
98	2	1.5-2	1-1.5
99	2	1.5-2	2-2.5
100	1.5-2	1.5	1
101	2	2	2.5-3
102	1.5(1.5-2.5)	3(1.5-3)	2
104	1.5	2	2
105	2-2.5	2	1
106	1.5-2.5	2.5	2
107	2.5(1.5-2.5)	2	2
108	1.5-2.5	2.5	2.5
109	2.5	2	2
110	2.5(2-2.5)	2.5	2.5
111	2	2	2(2-2.5)
112	2.5	2.5	2
113	2(2-2.5)	2	2
114	2	2.5	2.5
115	3.5-4	2	1
116	3.5-4	3	3
117	1	1	2
118	1-1.5	1	1.5
119	1.5	1.5	1.5
120	1	1	2
121	1	1	1.5
122	1	1	2
123	1.5	1	2
124	1.5	1	2
116a	3.5	1	1.5-2
117a	1	1	1.5
118a	1.5	1.5	2
119a	1.5	2	2
120a	1	2	2

Transect No.	Beaufort Sea State mode(range)	Glare	
		North mode(range)	South mode(range)
Blocks 1-4, southern Central Section			
1	2-2.5	2	2
2	1-2.5	2	2
3	1.5-2	2	2
4	1	1.5	2
5	1	1	1-1.5
6	0-1	0.5-1	0.5-1
7	0.5-1	1	1-1.5
8	0.5	1	1
9	0.5	1	1
10	0.5-1	1-1.5	1
11	0.5	1	1
12	1-1.5	1	2
13	1	1	2
14	1	0.5	1
15	1-1.5	1	1.5
16	3-4.5	2.5-3	2.5-3
17	4(3-4)	2.5	2
18	2.5-3.5	3	2.5-3
19	4	2	3
20	2-4	2	2
21	3	2.5	2.5
22	3-4	2	1.5
23	2.5-4	2	2.5
24	2-3	2-2.5	1.5
26	3(2.5-3)	2.5	2.5
28	3(2-3.5)	2.5	2.5
31	3(2.5-3)	2	1.5
32	3(2-3.5)	1.5-2.5	2.5
33	3(2.5-3.5)	2	1.5
34	3-4	2.5	2.5
35	3	2	2
36	3	3	2
37	3	2	2
38	2.5	2.5	2.5
40	3(2-4)	2.5	2
42	1	1	1
43	2	2	2.5
44	1-2	0.5-1	1-2
45	2-1.5	2	2.5
46	1.5	2	1.5
47	2-1.5	2	2.5
48	2.5	2	2
49	1.5-2.5	2	2.5
50	1.5-3	2.5-3	2
51	3	2.5-3	3

Transect No.	Beaufort Sea State mode(range)	Glare	
		North mode(range)	South mode(range)
Blocks 5-7, southern Central Section			
52	1.5	1	2
53	0.5=1.5	2	2
54	2(1.5-2)	1-2	2
55	0.5	1	1
56	1	1	2
57	1-1.5	1	1.5-2
58	1.5	2	2-2.5
59	2	1.5	2
60	1	1	2
61	1	1-2	1-1.5
62	1	1	2
63	1-1.5	2	1-2
64	1.5(1-1.5)	1	1
65	1(1-2)	1	1-2
66	1	1-1.5	2
67	0.5-1.5	1.5	2
68	1.5=2	1-2	2
69	1.5	2	2.5
70	0.5-2	2	2.5
71	0.5-1.5	1.5	2
72	0.5	2.5	2
73	1.5	2	2.5
74	0.5	2.5	2.5
75	2	2	2
76	2(1-4)	2	2
77	2.5(1-4)	3	2.5(2-2.5)
78	3(1-3)	1-2	2.5
79	3(2.5-3)	2.5	2(2-2.5)
80	3(1-3.5)	2(1-2)	3
81	1-3	2	1.5-3
82	1.5(1.5-2.5)	2	2
83	2.5-3	2.5	2
84	2(1-2)	1.5	2.5

Transect No.	Beaufort Sea State mode(range)	Glare	
		North mode(range)	South mode(range)
Blocks 8-10, northern Central Section			
1	0.5-1	0	1
2	1(1-2)	0	1
3	1-2	0	1
4	1.5(1-1.5)	0	1
5	0.5(0-2)	0(0-0.5)	0.5-1.5
6	0.5(0.5-3)	0	1
7	2.5(1-2.5)	0-0.5	1
8	2.5(1-3)	1.5-2	2
9	2(1-2)	2	2-2.5
10	2(2-2.5)	2	2
11	2(2-2.5)	1-2.5	2-3
12	3(2-3)	1-2	1-1.5
13	0.5,2(0-2.5)	2.5	2-2.5
14	0,2.5(0-3)	1	1(0-1)
15	0.5,3(0.5-3)	2.5(2-3)	2.5
16	3(0-4)	1-2	1-2
17	0.5(0-0.5)	2	2
18	0.5(0-1)	1-1.5	2
19	1(0-1)	1-2	1-2
20	0(0-1)	0	0
21	0.5(0-1)	2	2
22	0-1	0-1	1-2
23	0-1	1-2	1.5
24	2.5(1.5-3)	2-2.5	2-3
25	0-1	0.5	1
26	0	0.5	1
27	1-2	2	2
28	2	3	2.5
29	2(2-2.5)	2-2.5	2-3
30	2-3	2.5	2.5
31	2.5	2	2.5-3
32	2(2-3)	2	2-2.5
33	2	3	2-3
34	0.5(0-2)	1-2	1-2
35	0-0.5	1(0.5-1)	2(0.5-2.5)
36	0.5-1.5	2	2
37	0-1.5	1(1-2)	1-3
38	0.5(0-1)	0.5-1	1
51	0	0	0
52	0	0	0
53	0.5	0	0
54	0-0.5	0	0
55	0	0	0
56	0	0	0
57	0-1	0	0
58	0	0	0
59	1-2	1.5	2
60	2.5(1.5-3)	2	2
61	0	0.5-1	0-0.5
62	2(0.5-2)	1	1.5

Transect No.	Beaufort Sea State mode(range)	Glare	
		North mode(range)	South mode(range)
Block 11 northern Central Section, Blocks 12-13 Cairns Section			
39	1,1.5(1-1.5)	0.5	1-2
40	0.5	0-0.5	1-1.5
41	0(0-0.5)	0-0.5	1
42	1-0.5	0.5-1	1-1.5
43	0-0.5	0	1
44	0-1.5	0-0.5	1-2
45	0(0-1.5)	0	2
46	0(0-0.5)	1.5	1
47	0(0-0.5)	0	2
48	0-0.5	1	1-2
49	0.5-1.5	0-0.5	2
50	0-0.5	1	1.5-2.5
201	0(0-0.5)	0.5(0-0.5)	2(1-2)
202	1,2.5(0-3)	2-3	3
203	1-3	1-2	1.5-3
204	1(1-3)	0.5-3	2(2-3)
205	2(0-2)	2(1-2)	2(2-3)
206	0,1.5(0-2)	0.5-1	2
207	2(0-2)	2(1-2)	2(1.5-3)
208	0,2(0-2)	0.5(0.5-2)	2(1.5-2)
209	2(0.5-2.5)	2(1-2)	1-2.5
210	0(0-2)	0-1	1-1.5
211	1.5(0.5-1.5)	1-2	2-2.5
212	0-2	0.5-2	2
213	1(0.5-1.5)	2	2-3
214	1.5	0.5-2	2
215	0.5	2-3	1.5-2
216	0.5-2	1.5-2	2.5
217	0.5(0-2)	1-2.5	2-3
218	2(0.5-2)	2	1.5-3
219	2(0.5-3)	2.5-3	3
220	1-2.5	2	1.5-2
221	0-2.5	2	1-2
222	3(1-3)	1.5-3	2.5
223	2(0-2)	1	2
224	0.5-2	1	1
225	1.5(1-2)	1	2
226	1(0-2)	0-1	1(0-2)
227	1-2	2	2
228	0,1(0-2)	1	0.5-1
229	0,1(0-2)	0.5-1	1-2
230	0(0-1)	0-1	1
231	1(1-1.5)	0.5	1-2
232	1	0.5	2
233	0.5(0-0.5)	0.5(0.5-1)	1(0.5-1)
234	0.5,1(0-1)	1	2
235	0.5(0-2)	1	1-2

Transect No.	Beaufort Sea State mode(range)	Glare	
		North mode(range)	South mode(range)
Blocks 14-15 Cairns Section			
236	0(0-2)	0-1.5	2
237	0.5(0-2)	1	2-2.5
238	0,0.5(0-2)	0-1.5	2
239	0(0-1)	1(0-2)	2-2.5
240	0.5(0-2)	1	0.5-2.5
241	2.5(1.5-2.5)	2	2-2.5
242	1,2.5(0-2.5)	2	2.5
243	2(2-3)	2	2-3
244	1(1-2)	1(1-2)	2
245	2(1-2.5)	2	2.5-3
246	1(1-2.5)	1	2.5-3
247	2(1.5-2.5)	2	2-2.5
248	1(1-2.5)	0-1	2
249	1-2	2	2-3
250	1(1-2)	2(0-2)	2-2.5
251	1.5-2	2	2-3
252	1(0.5-2)	2	2-3
253	1.5	2	2-3
254	0.5-2	2	3
255	1-2	2	3
256	1	2	3
257	1,2(1-2.5)	2	1.5-2.5
258	2(1-2)	0.5-1.5	2-3
259	2(0-3)	1.5	2.5
260	1-2.5	0-2	2
261	3(0-3)	2	2-2.5

Table 2: Logistics of flight time for the survey.

Block	Transit Time (hrs)	Survey Time (hrs)
1-8: Mackay/Capricorn Section 1-4: Central Section	21.847	26.051
5-15: Central Section and Cairns Section	23.233	27.599

Table 3: Raw data for the surveys used in calculating correction factors: dugong sightings.
Transect numbers are indicated on Appendix Figures 1-18.

Transect no.	Port	Starboard	No. of groups of dugongs					
			Port			Starboard		
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 1-8, Mackay/Capricorn Section; Blocks 1-4 Central Section								
1	2	2	0	0	0	0	0	1
2	2	2	0	0	0	0	1	0
3	2	2	0	0	0	0	0	0
4	2	2	1	0	0	0	0	1
5	2	2	0	0	0	0	0	0
6	2	2	0	0	0	0	0	0
7	2	2	0	0	0	0	0	0
8	2	2	0	0	0	0	0	0
9	2	2	0	0	0	0	0	0
10	2	2	0	0	0	0	0	0
11	2	2	0	0	0	0	0	0
12	2	2	0	0	0	0	0	0
13	2	2	0	0	0	0	0	0
14	2	2	0	0	0	0	0	0
15	2	2	0	0	0	0	0	0
16	2	2	0	0	0	0	0	0
17	2	2	0	0	0	0	0	0
18	2	2	0	0	0	0	0	0
19	2	2	0	0	0	0	0	0
20	2	2	0	0	0	0	0	0
21	2	2	0	0	0	0	0	0
22	2	2	0	0	2	0	0	0
23	2	2	0	0	0	0	0	0
24	2	2	0	0	1	0	0	0
25	2	2	0	0	0	0	0	1
26	2	2	0	0	0	0	0	0
27	2	2	0	0	0	0	0	0
28	2	2	0	0	0	0	0	0
29	2	2	0	0	0	1	0	0
30	2	2	0	0	0	0	0	0
31	2	2	0	0	0	0	0	0
32	2	2	0	0	0	1	0	0
33	2	2	0	0	0	0	0	0
34	2	2	0	0	0	0	0	0
35	2	2	0	0	0	0	0	0
36	2	2	0	0	0	0	0	0
37	2	2	0	0	0	0	0	0
38	2	2	0	0	0	0	0	0
39	2	2	0	0	0	0	0	0
40	2	2	0	0	0	0	0	0
41	2	2	0	0	0	0	0	0
42	2	2	0	0	0	0	0	0
43	2	2	0	0	0	0	0	0
44	2	2	0	0	0	0	0	0
45	2	2	0	0	0	0	0	0
46	2	2	0	0	0	0	0	0
47	2	2	0	0	0	0	0	0
48	2	2	0	0	0	0	0	0
49	2	2	0	0	0	0	0	0
50	2	2	0	0	0	0	0	0
51	2	2	0	0	0	0	0	0
52	2	2	0	0	0	0	0	0
53	2	2	0	0	0	0	0	0
54	2	2	0	0	0	0	0	0

Transect no.	No. of groups of dugongs							
	Port	Starboard		Port			Starboard	
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 1-8, Mackay/Capricorn Section; Blocks 1-4 Central Section, continued.								
55	2	2	0	0	0	0	0	0
56	2	2	0	0	0	0	0	0
57	2	2	0	0	0	0	0	0
58	2	2	0	0	0	0	0	0
59	2	2	0	0	0	0	0	0
60	2	2	0	0	0	0	0	0
61	2	2	0	0	0	0	0	0
62	2	2	0	0	0	0	0	0
63	2	2	0	0	0	0	0	1
64	2	2	0	0	0	0	0	0
67	2	2	0	0	0	0	0	0
68	2	2	0	0	0	0	0	0
69	2	2	0	1	0	0	0	0
70	2	2	0	0	0	0	0	0
71	2	2	0	0	0	0	0	0
72	2	2	0	0	0	0	0	0
73	2	2	1	0	0	0	0	2
74	2	2	0	0	0	0	0	0
76	2	2	0	0	0	0	0	0
77	2	2	0	0	0	0	0	0
78	2	2	0	0	0	0	0	0
80	2	2	0	0	0	0	0	0
82	2	2	0	0	0	0	0	1
83	2	2	0	1	0	1	0	0
84	2	2	0	0	2	1	0	1
85	2	2	0	0	0	0	0	0
86	2	2	0	0	0	0	0	0
87	2	2	0	0	0	0	0	0
88	2	2	2	0	3	1	0	1
89	2	2	0	3	4	0	0	3
90	2	2	0	1	0	0	0	0
91	2	2	0	0	0	0	0	0
92	2	2	0	0	0	0	0	0
93	2	2	1	0	0	0	0	0
94	2	2	0	0	0	0	0	0
95	2	2	1	0	0	0	0	0
96	2	2	0	0	0	0	0	0
97	2	2	0	0	0	0	0	0
98	2	2	0	0	0	0	0	0
99	2	2	0	0	0	0	0	0
100	2	2	0	0	0	0	0	0
101	2	2	0	0	0	0	0	0
102	2	2	0	0	0	0	0	0
103	2	2	0	0	0	0	0	0
104	2	2	0	0	0	0	0	0
105	2	2	0	0	0	0	0	0
106	2	2	0	0	0	0	0	0
107	2	2	0	0	0	0	0	0
108	2	2	0	0	0	0	0	0
109	2	2	0	0	0	0	0	0
110	2	2	0	0	0	0	0	0
111	2	2	0	0	0	0	0	0
112	2	2	0	0	0	0	0	0
113	2	2	0	0	0	0	0	0
114	2	2	0	0	0	0	0	0
115	2	2	0	0	0	0	0	0
116	2	2	0	0	0	0	0	0
117	2	2	0	0	0	0	0	0
118	2	2	0	0	0	0	0	0
119	2	2	0	0	0	0	0	0
120	2	2	0	0	0	0	0	0

Transect no.	No. of groups of dugongs						
	Port			Port		Starboard		
		Starboard	Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 1-8, Mackay/Capricorn Section; Blocks 1-4 Central Section, continued.								
121	2	2	0	0	0	0	0	0
122	2	2	0	0	0	0	0	0
123	2	2	0	0	0	0	0	0
124	2	2	0	0	0	0	0	0
125	2	2	0	0	0	0	0	0
126	2	2	0	0	0	0	0	0
127	2	2	0	0	0	0	0	0
128	2	2	0	0	0	0	0	1
129	2	2	0	0	0	0	0	0
130	2	2	0	0	0	0	0	0
131	2	2	0	0	0	0	0	0
132	2	2	0	0	0	0	0	0
133	2	2	0	0	0	0	0	0
134	2	2	0	0	0	0	0	0
135	2	2	0	0	0	0	0	0
136	2	2	0	0	0	0	0	0
137	2	2	0	0	0	0	0	0
138	2	2	0	0	0	0	0	0
139	2	2	0	0	0	0	0	0
140	2	2	0	0	0	0	0	0
141	2	2	0	0	0	0	0	0
142	2	2	0	0	0	0	0	0
143	2	2	0	0	0	0	0	0
139a	2	2	0	0	0	0	0	0
140a	2	2	0	0	0	0	0	0
141a	2	2	0	0	0	0	0	0
142a	2	2	0	0	0	0	0	0
143a	2	2	0	0	0	0	0	0
144	2	2	0	0	1	0	0	0
145	2	2	0	0	0	0	0	0
146	2	2	0	0	0	0	0	0
147	2	2	0	0	0	0	0	0
148	2	2	0	0	0	0	0	0
149	2	2	0	0	0	0	0	0
150	2	2	0	0	0	0	0	0
151	2	2	0	0	0	1	0	0
152	2	2	0	0	0	1	0	0
153	2	2	0	0	0	0	0	0
154	2	2	0	0	0	0	0	0
155	2	2	0	0	0	0	0	0
156	2	2	0	0	0	0	0	0
157	2	2	0	0	0	0	0	0
158	2	2	0	0	0	0	0	0
159	2	2	0	0	0	0	0	0
160	2	2	0	0	0	0	0	0
161	2	2	0	0	0	0	0	0

Transect no.	Port	Starboard	No. of groups of dugongs					
			Port			Starboard		
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 1-4, Central Southern Section, continued								
162	2	2	0	0	0	0	0	0
163	2	2	0	0	0	0	0	0
164	2	2	0	0	0	0	0	0
165	2	2	0	0	0	0	0	0
166	2	2	0	0	0	0	0	0
167	2	2	0	0	0	0	0	0
168	2	2	0	0	0	0	0	0
169	2	2	0	0	0	0	0	0
177	2	2	0	0	0	0	0	0
178	2	2	0	0	0	0	0	0
179	2	2	0	0	1	0	0	0
180	2	2	0	0	0	0	0	0
189	2	2	0	0	0	0	0	0
190	2	2	1	0	0	0	0	0
191	2	2	0	0	0	0	0	0
192	2	2	0	0	0	0	0	0
193	2	2	0	0	0	0	0	0
194	2	2	0	0	0	0	0	0
195	2	2	0	0	0	0	0	0
196	2	2	0	0	0	0	0	0
197	2	2	0	1	0	0	0	0
			7	7	14	7	1	13

no.			No. of groups of dugongs					
	Port	Starboard	Port			Starboard		
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 5-15 Central Section								
198	1	1	1	0	0	0	0	0
199	1	1	0	0	0	0	0	0
200	1	1	0	0	0	0	0	0
201	1	1	0	0	0	0	0	0
202	1	1	0	0	0	0	0	0
203	1	1	0	0	0	0	0	0
204	1	1	0	0	0	0	0	0
205	1	1	0	0	0	0	0	0
206	1	1	1	0	0	0	0	0
207	1	1	1	0	0	0	0	0
208	1	1	0	0	0	1	0	0
209	1	1	0	0	0	0	0	0
210	1	1	0	0	0	0	0	0
211	1	1	0	0	0	0	0	0
212	1	1	0	0	0	0	0	0
213	1	1	0	0	0	0	0	0
214	1	1	0	0	0	0	0	0
215	1	1	0	0	0	0	0	0
216	1	1	0	0	0	0	0	0
217	1	1	0	0	0	0	0	0
218	1	1	0	0	0	0	0	0
219	1	1	0	0	0	0	0	0
220	1	1	0	0	0	0	0	0
221	1	1	0	0	0	0	0	0
222	1	1	0	0	0	0	0	0
223	2	1	0	0	0	0	0	0
224	2	1	0	1	0	0	0	0
225	2	1	0	0	0	0	0	0
226	2	1	0	0	0	0	0	0
227	2	1	0	0	0	0	0	0
228	2	1	0	0	0	0	0	0
229	2	1	0	0	0	0	0	0
230	1	1	0	0	0	0	0	0
231	1	1	0	0	0	0	0	0
232	2	1	0	0	0	0	0	0
233	2	1	0	0	0	1	0	0
234	2	1	0	0	0	0	0	0
235	2	1	0	0	0	0	0	0
236	2	1	1	0	0	1	0	0
237	2	1	0	0	0	0	0	0
242	2	1	0	0	0	0	0	0
244	2	1	0	0	0	0	0	0
238	2	1	0	0	0	0	0	0
240	2	1	0	0	0	0	0	0
245	2	2	0	1	0	0	0	0
246	2	2	0	0	0	0	1	0
247	2	2	0	0	0	0	0	0
248	2	2	0	0	0	0	0	0
249	2	2	0	0	0	0	0	0
250	2	2	0	0	0	0	0	0
251	2	2	0	0	0	0	0	0
252	2	2	0	0	0	0	0	0
259	2	2	0	0	0	0	0	0
260	2	2	0	0	0	0	0	0
261	2	2	0	0	0	0	0	0

no.	Port	Starboard	No. of groups of dugongs					
			Port			Starboard		
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 5-15 Central Section, continued.								
262	2	2	0	0	0	0	0	0
263	2	2	0	0	0	0	0	0
258	2	2	0	0	0	0	0	0
253	2	2	0	0	0	0	0	0
254	2	2	0	0	0	0	0	0
255	2	2	0	0	0	0	0	0
256	2	2	0	0	0	0	0	0
257	2	2	0	0	0	0	0	0
258	2	2	0	0	0	0	0	0
265	2	2	0	0	0	0	0	0
266	2	2	0	0	0	0	0	0
267	2	2	0	0	0	0	0	0
268	2	2	0	0	0	0	0	0
269	2	2	0	0	0	0	0	0
270	2	2	0	0	1	0	0	0
271	2	2	0	0	0	0	0	1
282	2	2	0	0	0	0	0	0
283	2	2	0	0	0	0	0	0
284	2	2	0	0	0	0	0	0
285	2	2	0	0	0	0	0	0
286	2	2	0	0	0	0	0	0
287	2	2	0	0	1	0	0	0
288	2	2	0	0	0	0	0	0
289	2	2	0	0	0	0	0	0
290	2	2	0	0	0	0	0	0
291	2	2	0	0	0	0	0	0
292	2	2	0	0	0	0	0	0
293	2	2	0	0	0	0	0	0
294	2	2	0	0	0	0	0	0
273	2	2	0	0	0	0	0	0
274	2	2	0	0	0	0	0	0
275	2	2	0	0	0	0	0	0
276	2	2	0	0	0	0	0	0
277	2	2	1	0	0	0	0	0
278	2	2	0	0	0	0	0	0
279	2	2	0	0	0	0	0	0
280	2	2	0	0	0	1	0	0
243	2	1	0	0	0	0	0	0
239	2	1	0	0	0	0	0	0
281	2	2	0	0	0	0	0	1
241	2	1	0	0	0	0	0	0
295	2	2	0	0	0	0	0	0
296	2	2	0	0	0	0	0	0
297	2	2	0	0	0	0	0	0
298	2	2	0	0	0	0	0	0
299	2	2	0	0	0	0	0	0
300	2	2	0	0	0	0	0	0
301	2	2	0	0	0	0	0	0
302	2	2	0	0	0	0	0	0
303	2	2	0	0	0	0	0	0
304	2	2	0	0	0	0	0	0
305	2	2	0	0	0	0	0	0
306	2	2	0	0	0	0	0	1
307	2	2	0	0	0	0	0	0
308	2	2	0	0	0	0	0	0

no.	Port	Starboard	No. of groups of dugongs					
			Port			Starboard		
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 5-15 Central Section, continued.								
309	2	2	0	0	0	0	0	0
310	2	2	0	0	0	0	0	0
311	2	2	0	0	0	0	0	0
312	2	2	0	0	0	0	0	0
313	2	2	0	0	0	0	0	0
314	2	2	0	0	0	0	0	0
315	2	2	0	0	0	0	0	0
316	2	2	0	0	0	0	0	0
317	2	2	0	0	0	0	0	0
318	2	2	0	0	0	0	0	0
319	2	2	0	0	0	0	0	0
325	2	2	0	0	0	0	0	0
326	2	2	0	0	0	0	0	0
327	2	2	0	0	0	0	0	0
328	2	2	0	0	0	0	0	0
329	2	2	0	0	0	0	0	0
330	2	2	0	0	0	0	0	0
331	2	2	0	0	0	0	0	0
332	2	2	0	0	0	0	0	0
333	2	2	0	0	0	0	0	0
334	2	2	0	0	0	0	0	0
335	2	2	0	0	0	0	0	0
336	2	2	0	0	0	0	0	0
337	2	2	0	0	0	0	0	0
338	2	2	0	0	0	0	0	0
339	2	2	0	0	1	0	0	1
340	2	2	0	0	0	0	0	0
341	2	2	0	0	0	0	0	0
342	2	2	0	0	0	0	0	0
343	2	2	0	0	0	0	0	0
344	2	2	0	0	0	0	0	0
345	2	2	0	0	0	0	0	0
346	2	2	0	0	0	0	0	0
347	2	2	0	0	0	0	0	0
348	2	2	0	0	0	0	0	0
349	2	2	0	0	0	0	0	0
350	2	2	0	0	0	0	0	0
351	2	2	0	0	0	0	0	0
352	2	2	0	0	1	0	0	1
353	2	2	0	1	1	0	0	0
354	2	2	0	0	1	0	0	0
355	2	2	0	0	0	0	0	0
356	2	2	0	0	0	0	0	0
357	2	2	0	0	0	0	0	0
359	2	2	0	0	0	0	0	0
361	2	2	0	0	0	0	0	0
363	2	2	0	0	1	0	0	0
321	2	2	0	0	0	0	0	0
322	2	2	0	0	0	0	0	0
323	2	2	1	0	0	0	0	1
324	2	2	0	0	0	0	0	0
320	2	2	0	0	0	0	0	0
358	2	2	0	0	0	0	0	0
360	2	2	0	0	0	0	0	0
362	2	2	0	0	0	0	0	0
364	2	2	0	0	0	0	0	0
			6	3	7	4	1	6

Table 4: Raw data used to calculate correction factors for dugongs for each survey or subsection of survey.

(a) Correction for perception bias.

Blocks	No. of groups of dugongs					
	Port			Starboard		
	mid-seat	rear-seat	tandem	mid-seat	rear-seat	tandem
1-8: Mackay/Capricorn Section 1-4: Central Section	17	16	25	14	5	33
5-15: Central Section and Cairns Section	6	3	7	4	1	6

(b) Correction for availability bias.

Blocks Total	Transects	No. of dugongs in groups ≤ 10		Total
		Surface	Underwater	
all blocks and transects		106	204	310

Table 5: Raw data for the analysis of variance and covariance: dugong sightings.

Block	Transect no.	Corrected density of dugongs 1986/1987	Corrected density of dugongs 1992
Mackay/Capricorn Section			
1S	10S	0	0
1S	11S	0	0
1S	12S	0	0
1S	13S	0	0
1S	14S	0	0
1S	1S	0	0.28
1S	2S	0	0.27
1S	3S	0	0
1S	4S	0	0.56
1S	5S	0	0
1S	6S	0.5	0
1S	7S	0	0
1S	8S	0	0
1S	9S	0	0
2S	17S	0	0
2S	18S	0	0.33
2S	19S	0	0
2S	20S	0	0.32
2S	21S	0	0
2S	22S	0	0
2S	23S	0	0.31
2S	24S	0	0
2S	25S	0	0
3S	11S	1.63	0
3S	125S	4.82	0
3S	126S	0.73	0
3S	127S	0	0
3S	128S	0	0
3S	129S	0	0
3S	12S	0.67	0
3S	130S	0	1.82
3S	131S	0	0.49
3S	132S	0	.
3S	134S	0	0
3S	135S	0.98	0
3S	136S	0	0
3S	137S	1.73	.
3S	13S	0	0
3S	14S	0	0
3S	15S	0	0
3S	16S	0	0
3S	17S	0	0
3S	18S	0	0.43
3S	19S	0	0
3S	25S	1.02	.
3S	26S	0	0
3S	27S	0	0
3S	28S	0	0
3S	29S	0	0
4S	30S	0	0

Block	Transect no.	Corrected density of dugongs 1986/1987	Corrected density of dugongs 1992
Mackay/Capricorn Section			
4S	31S	0	0
4S	32S	0	0
4S	33S	0.4	0
4S	34S	0	0
4S	35S	0	0
4S	36S	0	0
4S	37S	0	0
4S	38S	0	0
4S	39S	0	0
4S	40S	0	0
4S	41S	0	0
4S	42S	0	0
4S	43S	0	0
4S	44S	0	0
4S	45S	0	0
4S	46S	0	0
4S	47S	0	0
4S	48S	0	0
4S	49S	0	0
4S	50S	0	0.29
4S	51S	0	0
4S	52S	0	0
4S	53S	0	0
4S	54S	0	.
4S	55S	0	.
4S	56S	0	.
4S	57S	0	.
4S	58S	0	.
4S	75S	0	.
5S	138S	.	2
5S	139S	0	0
5S	140S	2.2	0
5S	141S	0	0
5S	142S	2.81	.
5S	143S	3.38	0
5S	144S	1.19	0.76
5S	49S	0	.
5S	50S	0	0
5S	52S	1.25	0
5S	54S	0	0
5S	55S	0	0
5S	56S	3	0
5S	59S	0.76	0.43
5S	60S	2.98	0.9
5S	61S	2.76	2.22
5S	62S	0	0
5S	63S	1.44	0
5S	64S	0	0
5S	65S	2.08	3
5S	66S	0.43	3.44
5S	67S	1.41	0
5S	68S	0.67	0
5S	69S	0.39	0

Block	Transect no.	Corrected density of dugongs 1986/1987	Corrected density of dugongs 1992
Mackay/Capricorn Section			
5S	70S	0	0.23
5S	71S	0.38	0
5S	72S	0	0.25
5S	73S	0	0
5S	74S	0	0
5S	75S	0.28	0
6S	100S	0	0
6S	101S	0	0
6S	102S	0	0
6S	103S	0	.
6S	104S	0	0
6S	105S	0.95	0.12
6S	106S	0	0
6S	76S	0	0
6S	77S	.	0
6S	78S	.	0
6S	79S	.	0
6S	80S	.	0
6S	81S	0	0
6S	82S	0	0
6S	83S	0.52	0
6S	84S	0	0
6S	85S	0	0
6S	86S	0.32	0
6S	87S	0	0
6S	88S	0.26	0
6S	89S	0.1	0
6S	90S	0.19	0
6S	91S	0	0
6S	92S	0	0
6S	93S	0	0
6S	94S	0	0
6S	95S	0	0
6S	96S	0	0
6S	97S	0	0
6S	98S	0	0
6S	99S	0	0
7S	107S	0	0
7S	108S	0	0
7S	109S	0	0
7S	110S	0	0
7S	111S	0	0
7S	112S	0	0
7S	113S	0	0
7S	114S	0	0
7S	115S	0	0
7S	116S	0	0
7S	116SA	.	0
8S	117S	1	0
8S	117SA	.	0
8S	118S	0	0
8S	118SA	.	0
8S	119S	0	0

Block	Transect no.	Corrected density of dugongs 1986/1987	Corrected density of dugongs 1992
Mackay/Capricorn Section			
8S	119SA	.	0
8S	120S	0.48	0
8S	120SA	.	0
8S	121S	0.49	0.32
8S	122S	0.49	0
8S	123S	0	0
8S	124S	0	0
Central Section			
1C	1N	0	0
1C	2N	0	0
1C	3N	0	0
1C	4N	0	1.24
1C	5N	0	0.27
1C	6N	0	0
1C	7N	1.32	0
1C	8N	0	0
1C	9N	0	0
2C	31N	0	0
2C	32N	0	0
2C	33N	0.7	0
2C	34N	0	0
2C	35N	0	0
2C	36N	0	0
2C	37N	0	0
3C	10N	0	0
3C	11N	0	0
3C	12N	0	0
3C	13N	0	0
3C	14N	0	0
3C	15N	0	0
3C	16N	0	0
3C	17N	0	0
3C	18N	0	0
3C	19N	0	0
3C	20N	0	0
3C	21N	0	0
3C	22N	0	0
3C	23N	0	0.22
3C	24N	0	0
3C	25N	0	.
3C	26N	0	0
3C	27N	0	.
3C	28N	0	0
3C	29N	0	.
3C	30N	0	.
3C	38N	0	0
3C	39N	0	.
3C	40N	0	0
3C	41N	0	.
4C	42N	0	0
4C	43N	0	0.45
4C	44N	0	0
4C	45N	0	0

Block	Transect no.	Corrected density of dugongs 1986/1987	Corrected density of dugongs 1992
Central Section			
4C	46N	0.65	0
4C	47N	0	0
4C	48N	0	0
4C	49N	0.76	0
4C	50N	0.63	0.34
4C	51N	1.27	0
5C	52N	0.66	0
5C	53N	1.72	0
5C	54N	0.33	0
5C	55N	0	0
5C	56N	0	0
5C	57N	0	0
5C	58N	0	0
5C	66N	0	0
5C	67N	0	0
5C	68N	0	0
5C	69N	0	0
5C	70N	0	0
5C	71N	0	0
5C	72N	0.67	0
5C	73N	0	0
5C	74N	0	0
5C	75N	0	0
5C	83N	0	0
5C	84N	0	0
6C	59N	0	1.78
6C	60N	0	1.3
6C	61N	1.13	0.87
6C	62N	2.18	0
6C	63N	1.91	0
6C	64N	0	0
6C	65N	0	0
7C	76N	1.42	0
7C	77N	0.43	0.69
7C	78N	0	0
7C	79N	0	0
7C	80N	0	0
7C	81N	0	0
7C	82N	0	0
8C	10T	0	0
8C	1T	0	0
8C	2T	1.03	1.55
8C	3T	1.63	0
8C	4T	0.78	0
8C	59T	0.75	0
8C	5T	0	0.89
8C	60T	0	0
8C	62T	0	0
8C	6T	1.25	0
8C	7T	2.3	0
8C	8T	0	0
8C	9T	0	0
9C	11T	0	0.56

Block	Transect no.	Corrected density of dugongs 1986/1987	Corrected density of dugongs 1992
Central Section			
9C	12T	0	0.24
9C	13T	0	0
9C	14T	0	0
9C	15T	0	0
9C	16T	0	0
9C	17T	0	0
9C	18T	0	0
9C	19T	0	0
9C	20T	0	0
9C	21T	0	0
9C	22T	0	0
9C	23T	0	0
9C	24T	0	0
9C	25T	0	0
9C	26T	0	0
9C	27T	0	0
9C	28T	0	0
9C	29T	0	0
9C	30T	0	0
9C	31T	0	0
9C	32T	0	0
9C	33T	0	0
9C	34T	0	0
9C	35T	0	0
9C	36T	0	0.52
9C	37T	0	0.47
9C	38T	0	0
9C	39T	0	0
10C	38T	0	0
10C	51T	0	0
10C	52T	0	0
10C	53T	0	0
10C	54T	0	0
10C	55T	0	1.15
10C	56T	1.63	0
10C	57T	6.2	0
10C	58T	8.27	11.33
10C	61T	0	0.88
11C	39T	0	0
11C	40T	0	0
11C	41T	0	0
11C	42T	0	0
11C	43T	0.67	1.56
11C	44T	0	0
11C	45T	0	0
11C	46T	0	0
11C	47T	0	0
11C	48T	0	0
11C	49T	0	0
11C	50T	1.28	0

Table 6: Raw data for the surveys used in calculating correction factors: turtle sightings.
Transect numbers in Appendix Figures 1-18.

Transect no.	No. of observers		No. of groups of turtles					
	Port	Starboard		Port			Starboard	
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 1-8, Mackay/Capricorn Section; Blocks 1-4 Central Section								
1	2	2	0	0	0	0	0	2
2	2	2	0	0	0	0	0	0
3	2	2	0	1	0	1	0	0
4	2	2	0	1	0	0	0	1
5	2	2	0	0	0	1	0	0
6	2	2	0	0	0	0	0	0
7	2	2	1	0	1	1	0	3
8	2	2	1	0	0	3	0	0
9	2	2	2	1	0	0	0	0
10	2	2	0	0	0	0	0	0
11	2	2	0	0	0	0	0	0
12	2	2	0	0	0	0	0	1
13	2	2	1	2	1	2	0	0
17	2	2	0	1	0	0	0	0
19	2	2	0	2	1	0	0	0
21	2	2	0	0	2	0	0	0
23	2	2	0	1	1	1	0	1
25	2	2	3	0	1	1	0	2
27	2	2	1	0	0	0	0	1
29	2	2	0	0	0	1	0	0
30	2	2	0	0	0	0	0	0
31	2	2	0	0	0	0	0	0
32	2	2	0	0	0	0	0	0
33	2	2	0	1	0	0	1	1
34	2	2	1	0	1	0	0	0
36	2	2	0	0	0	0	0	0
38	2	2	0	0	0	0	0	0
40	2	2	0	0	0	0	0	0
42	2	2	0	0	0	1	0	1
43	2	2	0	0	0	0	0	0
44	2	2	0	2	0	0	0	0
45	2	2	0	1	0	0	0	0
46	2	2	0	0	0	0	0	0
47	2	2	0	0	0	0	0	0
48	2	2	0	0	0	0	0	0
49	2	2	0	1	0	2	0	0
50	2	2	0	0	0	0	0	0
51	2	2	0	0	1	0	0	0
52	2	2	0	0	0	0	0	1
53	2	2	0	0	0	0	0	0
54	2	2	0	0	0	0	0	0
55	2	2	0	0	1	0	0	0
56	2	2	0	0	0	0	0	0
57	2	2	0	0	0	0	1	0
58	2	2	0	0	0	0	0	0
59	2	2	0	0	1	0	0	0
60	2	2	0	0	0	0	0	1
61	2	2	0	0	0	0	0	0
62	2	2	0	0	0	0	0	0
63	2	2	0	0	0	0	0	2
64	2	2	0	1	1	0	0	0
70	2	2	0	1	1	0	0	3
71	2	2	0	0	0	0	1	0

Transect no.	No. of groups of turtles							
	Port	Starboard		Port			Starboard	
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 1-8, Mackay/Capricorn Section; Blocks 1-4 Central Section, continued.								
72	2	2	0	0	1	0	0	0
74	2	2	0	0	0	2	0	0
76	2	2	1	1	0	0	0	0
77	2	2	1	0	0	0	0	0
78	2	2	0	0	0	0	0	0
82	2	2	0	0	1	1	0	2
83	2	2	1	1	2	2	1	4
84	2	2	5	0	4	1	0	3
85	2	2	0	1	1	2	0	0
86	2	2	2	0	5	0	0	6
87	2	2	1	1	0	2	2	1
88	2	2	3	2	2	4	1	7
89	2	2	2	3	9	1	0	8
90	2	2	2	3	2	0	1	4
91	2	2	0	0	0	2	0	3
92	2	2	0	0	1	5	0	8
93	2	2	1	0	1	1	0	3
94	2	2	7	0	0	4	0	0
95	2	2	2	0	1	1	0	2
96	2	2	0	2	2	0	1	1
97	2	2	6	0	1	3	1	2
98	2	2	0	0	0	0	0	3
99	2	2	1	0	1	0	1	0
100	2	2	0	0	0	0	0	0
101	2	2	0	0	0	0	0	0
102	2	2	0	0	0	0	0	0
103	2	2	0	0	0	0	0	0
104	2	2	0	0	0	0	0	0
105	2	2	0	0	0	0	0	0
106	2	2	0	0	0	0	0	0
107	2	2	0	0	0	1	0	0
108	2	2	1	0	0	2	0	0
109	2	2	1	1	1	1	0	0
110	2	2	0	1	2	0	0	0
111	2	2	0	0	1	0	0	0
112	2	2	0	1	1	0	0	2
113	2	2	0	1	2	2	0	1
114	2	2	0	0	0	1	0	0
115	2	2	0	2	0	3	1	1
116	2	2	1	1	0	0	0	2
117	2	2	1	3	1	1	0	1
118	2	2	0	1	1	0	1	0
119	2	2	0	0	1	1	1	4
120	2	2	0	0	0	1	0	0
121	2	2	0	0	0	0	0	1
122	2	2	0	0	0	1	0	0
123	2	2	0	0	0	0	0	1
124	2	2	1	0	0	2	0	0
125	2	2	0	0	0	1	0	1
126	2	2	2	0	1	0	0	2
127	2	2	1	1	4	3	0	3
128	2	2	0	1	2	0	0	2
129	2	2	1	1	0	0	0	1
130	2	2	2	0	0	0	0	0
131	2	2	0	0	0	0	0	1

Transect no.	Port	Starboard	No. of groups of turtles					
			Port			Starboard		
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 1-8, Mackay/Capricorn Section; Blocks 1-4 Central Section, continued.								
132	2	2	0	0	1	0	0	2
133	2	2	0	1	0	0	0	1
134	2	2	0	0	1	0	0	1
135	2	2	0	0	0	0	0	1
136	2	2	0	0	0	0	0	0
137	2	2	0	0	0	0	0	0
138	2	2	0	0	0	0	0	0
139	2	2	0	0	0	0	0	1
140	2	2	1	0	3	0	0	0
141	2	2	0	0	0	1	0	0
142	2	2	0	4	1	2	1	5
143	2	2	0	0	3	2	0	0
144	2	2	0	0	0	0	0	1
145	2	2	0	0	0	1	0	0
146	2	2	1	0	0	0	0	1
147	2	2	0	0	0	0	0	1
139a	2	2	1	1	0	0	0	0
140a	2	2	0	0	0	0	0	0
141a	2	2	0	0	0	0	0	0
142a	2	2	0	0	5	1	0	2
143a	2	2	0	0	1	0	2	1
14	2	2	0	3	1	2	0	2
15	2	2	0	2	1	1	0	4
16	2	2	2	1	2	3	1	0
18	2	2	0	0	0	0	0	0
20	2	2	0	0	0	0	0	0
22	2	2	0	1	2	1	0	6
24	2	2	0	0	0	1	0	2
26	2	2	0	0	0	0	0	0
28	2	2	0	0	0	0	0	0
35	2	2	0	1	0	0	0	0
37	2	2	0	0	1	0	1	0
39	2	2	0	0	0	0	0	0
41	2	2	0	0	7	0	0	8
80	2	2	0	0	0	1	0	0
68	2	2	0	0	0	0	0	0
73	2	2	1	1	0	0	0	1
67	2	2	0	0	0	0	0	1
69	2	2	1	0	0	0	0	0

Blocks 1-4, Central Southern Section, continued

Transect no.	Port	Starboard	No. of groups of turtles					
			Port			Starboard		
			Mid	Rear	Tandem	Mid	Rear	Tandem
148	2	2	0	0	0	3	0	1
149	2	2	0	0	0	0	1	0
150	2	2	0	2	0	0	0	1
151	2	2	1	0	0	0	0	0
152	2	2	0	0	0	0	2	1
153	2	2	0	0	0	0	0	2
154	2	2	0	2	0	0	0	2
155	2	2	1	0	0	0	0	0
156	2	2	0	1	0	0	0	1
157	2	2	0	0	0	0	0	1
158	2	2	1	0	0	1	0	3
161	2	2	1	0	3	0	0	2
162	2	2	0	0	0	0	0	0
163	2	2	1	0	0	0	0	1
164	2	2	0	0	0	0	0	0
165	2	2	0	0	1	0	0	0
166	2	2	0	0	0	0	0	0
167	2	2	0	0	0	0	0	1
168	2	2	0	0	0	0	0	0
169	2	2	3	0	0	1	0	0
177	2	2	0	0	1	3	0	0
178	2	2	0	0	1	1	0	2
179	2	2	0	0	1	0	1	0
180	2	2	1	1	4	3	1	4
182	2	2	0	0	0	0	0	0
184	2	2	1	0	0	0	1	0
159	2	2	1	0	0	0	0	0
160	2	2	1	0	0	0	0	1
170	2	2	1	0	0	0	0	1
171	2	2	0	0	0	0	0	0
172	2	2	0	0	1	0	0	0
173	2	2	0	0	1	0	0	0
174	2	2	0	0	0	0	0	1
175	2	2	0	0	0	0	0	0
185	2	2	1	1	0	0	0	0
187	2	2	0	0	0	0	1	2
189	2	2	0	0	0	0	0	0
190	2	2	0	0	1	0	0	0
191	2	2	0	2	0	0	1	0
192	2	2	0	0	0	1	0	1
193	2	2	0	1	2	0	0	0
194	2	2	0	0	0	1	0	3
195	2	2	1	0	0	0	0	0
196	2	2	0	0	2	0	0	1
197	2	2	0	2	2	0	0	0
			78	71	113	95	27	173

Transect no.	Port	Starboard	No. of groups of turtles					
			Mid	Port Rear	Tandem	Mid	Starboard Rear	Tandem
Blocks 5-15 Central Section and Cairns Section								
198	1	1	0	0	0	1	0	0
199	1	1	1	0	0	0	0	0
200	1	1	0	0	0	1	0	0
201	1	1	4	0	0	1	0	0
202	1	1	1	0	0	0	0	0
203	1	1	0	0	0	0	0	0
204	1	1	0	0	0	0	0	0
205	1	1	0	0	0	0	0	0
206	1	1	4	0	0	1	0	0
207	1	1	1	0	0	2	0	0
208	1	1	0	0	0	0	0	0
209	1	1	0	0	0	0	0	0
210	1	1	2	0	0	0	0	0
211	1	1	0	0	0	0	0	0
212	1	1	0	0	0	0	0	0
213	1	1	0	0	0	0	0	0
214	1	1	0	0	0	0	0	0
215	1	1	0	0	0	0	0	0
216	1	1	0	0	0	0	0	0
217	1	1	0	0	0	0	0	0
218	1	1	0	0	0	0	0	0
219	1	1	0	0	0	1	0	0
220	1	1	0	0	0	1	0	0
221	1	1	0	0	0	0	0	0
222	1	1	0	0	0	0	0	0
223	2	1	0	0	0	1	0	0
224	2	1	0	0	0	0	0	0
225	2	1	0	0	0	0	0	0
226	2	1	0	1	0	0	0	0
227	2	1	0	0	0	0	0	0
228	2	1	0	0	0	0	0	0
229	2	1	0	0	0	0	0	0
230	1	1	0	0	0	2	0	0
231	1	1	0	1	0	0	0	0
232	2	1	0	0	0	0	0	0
233	2	1	0	0	1	3	0	0
234	2	1	0	1	1	1	1	0
235	2	1	0	0	0	0	0	0
236	2	1	1	3	0	0	0	0
237	2	1	0	1	2	3	0	4
242	2	1	0	1	1	1	0	0
244	2	1	0	0	1	0	0	0
238	2	1	0	0	0	0	0	0
240	2	1	0	0	0	0	0	0
245	2	2	0	1	1	1	0	0
246	2	2	0	2	0	1	0	1
247	2	2	2	0	1	1	1	6
248	2	2	1	0	0	0	0	5
249	2	2	0	2	8	1	0	2

Transect no.	No. of groups of turtles							
	Port	Starboard		Port			Starboard	
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 5-15 Central Section, continued.								
250	2	2	0	0	1	0	0	2
251	2	2	0	1	2	1	1	4
252	2	2	0	0	0	0	0	2
259	2	2	0	0	1	0	0	2
260	2	2	0	0	1	0	0	0
261	2	2	0	1	0	0	0	0
262	2	2	0	0	1	0	0	1
263	2	2	1	0	0	0	0	0
258	2	2	0	1	0	0	0	0
253	2	2	0	0	1	0	0	1
254	2	2	0	0	0	0	0	0
255	2	2	0	0	4	1	0	0
256	2	2	0	0	0	0	0	0
257	2	2	0	0	0	0	1	1
258	2	2	0	0	1	0	0	0
265	2	2	0	0	0	1	0	0
266	2	2	0	0	0	0	0	0
267	2	2	0	0	0	0	0	0
268	2	2	0	0	3	0	0	2
269	2	2	0	0	1	0	0	0
270	2	2	0	1	1	0	0	0
271	2	2	1	0	0	0	0	5
282	2	2	1	0	1	0	1	2
283	2	2	2	0	0	1	0	0
284	2	2	0	0	1	0	0	7
285	2	2	0	0	0	1	0	1
286	2	2	0	0	0	0	0	0
287	2	2	0	0	0	0	0	1
288	2	2	0	0	0	0	1	1
272	2	2	0	0	0	0	0	1
290	2	2	0	0	2	4	0	2
291	2	2	0	0	0	0	0	0
292	2	2	1	0	1	0	0	1
293	2	2	1	0	0	0	0	0
294	2	2	0	0	3	0	0	2
273	2	2	1	1	1	0	1	2
274	2	2	0	1	2	0	0	1
275	2	2	0	0	0	0	0	0
276	2	2	0	0	0	0	0	0
277	2	2	0	1	0	0	0	2
278	2	2	0	0	0	0	0	4
279	2	2	1	0	3	1	0	0
280	2	2	0	0	0	2	0	2
243	2	1	0	0	0	0	0	0
239	2	1	0	0	0	1	0	0
281	2	2	0	0	0	0	0	1
241	2	1	0	1	1	1	0	0
295	2	2	0	0	1	0	0	0
296	2	2	0	0	0	0	0	0

Transect no.	Port	Starboard	No. of groups of turtles					
			Port			Starboard		
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 5-15 Central Section, continued.								
297	2	2	0	0	2	0	0	0
298	2	2	2	0	6	0	1	6
299	2	2	3	0	3	1	0	5
300	2	2	0	1	0	0	0	1
301	2	2	0	0	1	2	0	0
302	2	2	0	0	0	3	0	1
303	2	2	0	0	0	0	0	1
304	2	2	0	0	0	2	0	0
305	2	2	0	0	0	0	0	0
306	2	2	0	0	1	1	0	0
307	2	2	0	0	0	0	0	0
308	2	2	0	0	0	0	0	0
309	2	2	0	0	0	0	0	0
310	2	2	0	1	0	0	0	0
311	2	2	0	0	0	0	0	0
312	2	2	0	0	0	0	0	0
313	2	2	0	0	0	0	0	0
314	2	2	0	0	0	0	0	0
315	2	2	0	0	0	0	0	1
316	2	2	0	0	0	0	0	0
317	2	2	0	0	0	0	0	0
318	2	2	0	0	1	0	0	0
319	2	2	0	0	0	0	0	0
325	2	2	0	0	1	2	0	0
326	2	2	0	0	0	0	0	1
327	2	2	1	1	1	1	2	4
328	2	2	6	0	0	5	0	0
329	2	2	1	1	4	5	1	4
330	2	2	0	1	1	0	0	0
331	2	2	0	0	0	0	0	0
332	2	2	0	1	0	1	0	0
333	2	2	1	0	2	2	0	1
334	2	2	0	0	0	0	1	0
335	2	2	1	0	1	0	0	0
336	2	2	1	0	0	0	0	1
337	2	2	0	3	5	2	0	7
338	2	2	0	0	0	0	0	1
339	2	2	2	0	4	1	1	0
340	2	2	0	0	1	1	0	0
341	2	2	0	1	0	0	2	1
342	2	2	0	0	0	0	0	0
343	2	2	3	0	0	1	0	0
344	2	2	1	1	2	0	1	2
345	2	2	0	1	1	0	1	0
346	2	2	0	1	0	0	0	0
347	2	2	0	0	0	1	0	3
348	2	2	0	0	0	0	0	0
349	2	2	2	2	0	0	0	0
350	2	2	0	0	0	0	0	0

Transect no.	Port	Starboard	No. of groups of turtles					
			Port			Starboard		
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 5-15 Central Section, continued.								
351	2	1	0	0	0	3	1	2
352	2	1	3	2	1	1	0	1
353	2	2	6	1	3	3	0	0
354	2	1	1	1	4	2	0	2
355	2	2	5	2	2	5	0	1
356	2	2	1	0	0	7	0	0
357	2	2	1	0	0	0	0	2
359	2	2	1	2	2	4	1	2
361	2	2	0	0	1	0	0	0
363	2	2	2	3	3	3	0	3
321	2	2	0	0	0	0	0	0
322	2	2	0	0	0	1	0	0
323	2	2	0	0	1	0	0	4
324	2	2	1	0	1	0	0	1
320	2	2	1	0	6	0	0	4
358	2	2	0	0	0	0	0	0
360	2	2	0	0	1	1	0	0
362	2	2	0	0	0	0	0	0
364	2	2	1	0	0	0	0	0
			73	47	111	98	19	130

Table 7: Raw data used to calculate correction factors for turtles for each survey or subsection of survey.

(a) Correction for perception bias.

Blocks	No. of groups of turtles					
	Port			Starboard		
	mid-seat	rear-seat	tandem	mid-seat	rear-seat	tandem
1-8: Mackay/Capricorn Section 1-4: Central Section	118	82	163	148	46	253
5-15: Central Section and Cairns Section	73	47	111	97	19	130

(b) Correction for availability bias.

Blocks Total	Transects	No. of turtles in groups ≤ 10		Total
		Surface	Underwater	
all blocks and transects		765	939	1704

Table 8: Raw data for the analysis of variance and covariance: turtle sightings.

Block	Transect no.	Corrected density of turtles 1986/1987	Corrected density of turtles 1992
Mackay/Capricorn Section			
1S	10	0	0
1S	11	0.33	0
1S	12	0	0.33
1S	13	0.61	1.9
1S	17	0	0.63
1S	1	1.26	0.55
1S	2	0	0
1S	3	0.62	0.7
1S	4	0	0.55
1S	5	0.32	0.33
1S	6	0.32	0
1S	7	0	2.14
1S	8	0	1.38
1S	9	0.26	0.88
2S	23	0.3	1.42
2S	25	0.6	2.43
2S	27	0.64	0.74
2S	29	0.95	0.32
2S	30	0.61	0
2S	31	0	0
2S	32	0.6	0
2S	33	0.6	1.03
2S	34	1.78	0.5
3S	11	6.51	0
3S	14	7.93	4.31
3S	15	6.95	5.38
3S	16	0.36	3.88
3S	18	1.37	0
3S	20	0.51	0
3S	12	5.48	0.41
3S	22	3.86	9.76
3S	24	3.38	1.3
3S	26	3.83	.
3S	35	0	0
3S	37	0.29	0
3S	39	1.82	0.63
3S	41	4.86	.
3S	13	3.49	0
3S	17	1.64	0
3S	19	0.93	0
3S	21	0.98	0
3S	23	0.84	0
3S	25	0.43	0.43
3S	27	0	0
3S	34	0	.
3S	36	0	0
3S	38	0.42	0
3S	40	3.25	0
3S	42	2.57	0.92
4S	43	1.1	0

Block	Transect no.	Corrected density of turtles 1986/1987	Corrected density of turtles 1992
Mackay/Capricorn Section			
4S	44	1.54	0.44
4S	45	0.82	0.24
4S	46	0.75	0
4S	47	0.9	0
4S	48	0.85	0
4S	49	1.21	0.97
4S	50	0.28	0
4S	51	0.6	0.34
4S	52	0.61	0.33
4S	53	0	0
4S	54	0	0
4S	55	0	0.36
4S	56	0.62	0
4S	57	0.3	0.32
4S	58	0.62	0
4S	59	0.32	0.37
4S	60	0	0.36
4S	61	0.32	0
4S	62	0	0
4S	63	0	0.59
4S	64	0	0
4S	70	0	0
4S	71	0.32	0
4S	72	0	.
4S	74	0	.
4S	76	0	.
4S	77	0.63	.
4S	78	0	.
4S	98	0	.
5S	80	.	0
5S	68	1.04	2
5S	73	9.6	25.57
5S	75	0	3.75
5S	81	3.44	.
5S	67	15	0.73
5S	69	3	.
5S	62	6.88	.
5S	63	5.6	7.5
5S	70	5.42	3.93
5S	72	6.75	16.5
5S	74	11.86	15.17
5S	76	0	3.88
5S	82	3.75	1.79
5S	83	3.22	5.28
5S	84	3.37	7.22
5S	85	2.42	3.8
5S	86	4.5	5.91
5S	87	3.73	2.78
5S	88	7.4	7.23
5S	89	2.46	5.89
5S	90	1.28	2.74
5S	91	2.93	1.28
5S	92	2.46	8.65

Block	Transect no.	Corrected density of turtles 1986/1987	Corrected density of turtles 1992
Mackay/Capricorn Section			
5S	93	1.74	1.29
5S	94	2.79	3.42
5S	95	2.38	1.41
5S	96	2.74	1.28
5S	97	5.51	2.68
5S	98	1.24	0.56
6S	123	0.35	0.18
6S	124	1.32	0.51
6S	125	0	0.37
6S	126	0.91	1.19
6S	127	0.44	1.38
6S	128	1.77	0.65
6S	129	0.66	0.19
6S	99	0.12	0.38
6S	100	.	0
6S	101	.	0
6S	102	.	0
6S	103	.	0
6S	104	0.3	0
6S	105	0	0
6S	106	0	0
6S	107	1.45	0.27
6S	108	0.76	0.61
6S	109	0.4	0.96
6S	110	0.35	0.59
6S	111	0.8	0.19
6S	112	0.11	0.3
6S	113	0.3	0.62
6S	114	0.14	0.08
6S	115	0.53	0.94
6S	116	1.82	0.46
6S	117	0	0.95
6S	118	0.2	0.7
6S	119	0.41	2.99
6S	120	0.73	0.19
6S	121	0.38	0.19
6S	122	1.08	0.18
7S	130	0.19	0.4
7S	131	0.35	0.18
7S	132	0.36	0.57
7S	133	0.14	0.31
7S	134	0.14	0.3
7S	135	0.14	0.16
7S	136	0.31	0
7S	137	0	0
7S	138	0.31	0
7S	139	0.9	0.33
7S	139a	.	0.69
8S	140	1.25	1.46
8S	140a	.	0
8S	141	1.2	0.33
8S	141a	.	0
8S	142	5.35	5.9

Block	Transect no.	Corrected density of turtles 1986/1987	Corrected density of turtles 1992
Mackay/Capricorn Section			
8S	142a	.	2.71
8S	143	6.73	1.79
8S	143a	.	2.14
8S	144	2.42	0.28
8S	145	0.3	0.32
8S	146	1.57	0.71
8S	147	0.3	0.33
Central Section			
1C	148	0.86	1.61
1C	149	0.53	0.34
1C	150	0.58	1.12
1C	151	0	0.34
1C	152	0.86	0.83
1C	153	0	0.91
1C	154	0	2.52
1C	155	1.02	0.65
1C	156	15.36	5.25
2C	170	0.81	0.72
2C	171	0.55	0
2C	172	0.27	0.38
2C	173	1.09	0.38
2C	174	0.27	0.35
2C	175	0	0
2C	176	0.27	0
3C	157	0.81	0.34
3C	158	0.51	3.28
3C	161	1.67	2.72
3C	162	1.11	0
3C	163	0.3	0.66
3C	164	0.68	0
3C	165	0.6	0.35
3C	166	0.99	0
3C	167	0	0.26
3C	168	0	0
3C	169	1.18	1.46
3C	177	0	2.18
3C	178	0.82	1
3C	179	0.34	0.41
3C	180	0.29	2.66
3C	181	0	.
3C	182	0	0.46
3C	183	0.33	.
3C	184	0.9	0.46
3C	185	3	3.67
3C	186	0.8	.
3C	187	0	0.7
3C	188	0.28	.
4C	189	0	0
4C	190	0.38	0.44
4C	191	0.39	1.5
4C	192	1.16	1.26
4C	193	1.78	1.66
4C	194	0.7	1.39

Block	Transect no.	Corrected density of turtles 1986/1987	Corrected density of turtles 1992
Central Section			
4C	195	0.26	0.41
4C	196	0.3	1.33
4C	197	0.24	1.32
4C	198	0	0.34
5C	199	0.78	0.35
5C	200	1.36	0.71
5C	201	0.13	0.84
5C	202	0.55	0.35
5C	203	0.53	0
5C	204	0	0
5C	205	1.09	0
5C	213	0.26	0
5C	214	1.63	0
5C	215	0.54	0
5C	216	0	0
5C	217	0	0
5C	218	0	0
5C	219	0	0.28
5C	220	0.27	0.28
5C	221	0.26	0
5C	222	0	0
5C	230	0	0.33
5C	231	0.28	0.35
6C	206	0.81	4.53
6C	207	2.71	1.8
6C	208	1.78	0
6C	209	0	0
6C	210	1.12	0.94
6C	211	1.65	0
6C	212	0.36	0
7C	223	1.47	0.28
7C	224	0.34	0
7C	225	0.33	0
7C	226	0.33	0.16
7C	227	0.16	0
7C	228	0	0
7C	229	0	0
8C	240	0	0
8C	232	0.63	0
8C	233	0.42	1.62
8C	234	0.32	1.24
8C	235	0.91	0
8C	243	0.3	0
8C	236	1.42	0.92
8C	239	0.29	0.55
8C	241	2.72	0.97
8C	237	0.98	2.37
8C	242	2.99	0.9
8C	244	1.51	0.24
8C	238	0	0
9C	245	0.15	0.42
9C	246	0.27	0.52
9C	247	0.26	1.35

Block	Transect no.	Corrected density of turtles 1986/1987	Corrected density of turtles 1992
Central Section			
9C	248	0.35	0.66
9C	249	0	1.41
9C	250	0	0.45
9C	251	0.13	0.94
9C	252	0	0.24
9C	259	0.54	0.58
9C	260	0	0.2
9C	261	0.31	0.33
9C	262	0.72	0.78
9C	263	0	0.4
9C	258	0.32	0.16
9C	253	0	0.52
9C	254	0	0
9C	255	0.29	1.33
9C	256	0	0
9C	257	0	0.51
9C	258	0	0.27
9C	265	0	0.25
9C	266	0	0
9C	267	0.32	0
9C	268	0.3	1.31
9C	269	0	0.27
9C	270	0.89	0.54
9C	271	0	1.28
9C	282	0.88	1.56
10C	272	0.27	1.53
10C	273	0.33	0.99
10C	274	0.18	0.76
10C	275	0	0
10C	276	1.88	0
10C	277	0	1.73
10C	278	1.26	2.95
10C	279	0	3.13
10C	280	1.6	6
10C	281	0.94	0.94
11C	283	0.14	0.39
11C	284	0.48	2.48
11C	285	0	0.38
11C	286	0	0
11C	287	0	0.25
11C	288	0	0.51
11C	289	0.26	0.24
11C	290	0.5	2.06
11C	291	0.25	0
11C	292	0	1.06
11C	293	0	0.27
11C	294	0.51	1.31
Cairns Section			
12C	295	0	0.27
12C	296	0	0
12C	297	0.25	0.24
12C	298	0.66	1.86
12C	299	0.5	2.1

Block	Transect no.	Corrected density of turtles 1986/1987	Corrected density of turtles 1992
Cairns Section			
12C	300	0.36	0.52
12C	301	0.5	0.46
12C	302	0	0.65
12C	303	0.16	0.15
12C	304	1.45	0.34
12C	305	0.33	0
12C	306	0	0.32
12C	307	0	0
12C	308	0.28	0
12C	309	0	0
12C	310	0.28	0.27
12C	311	0	0
12C	312	0.55	0
12C	313	0.27	0
12C	314	0	0
12C	315	0.4	0.92
12C	316	0.17	0
12C	317	0.37	0
12C	318	0	0.26
12C	319	0.54	0
12C	325	0.35	0.51
13C	326	0.63	0.2
13C	327	0.4	2.21
13C	328	0.85	2.04
13C	329	1.17	2.54
13C	330	0.21	0.21
13C	331	0.57	0
13C	332	0.65	0.2
13C	333	0.22	0.63
13C	334	0	0.09
13C	320	1.16	.
14C	335	0.81	0.26
14C	336	0.68	0.26
14C	337	1.41	2.21
14C	338	0.12	0.1
14C	339	0.86	0.97
14C	340	0.81	0.25
14C	341	1.84	0.48
14C	342	0	0
14C	343	0.73	0.56
14C	344	1.19	0.97
14C	345	1.55	0.4
14C	346	1.27	0.14
14C	347	1.5	0.51
14C	348	2.69	0
14C	349	1.78	0.49
14C	350	0	0
14C	351	0.77	0.7
14C	352	1.41	1.16
14C	353	2.13	3.98
14C	354	1.4	2.07
14C	355	2.27	19.04
14C	356	0.71	1.34

Block	Transect no.	Corrected density of turtles 1986/1987	Corrected density of turtles 1992
Cairns Section			
15C	357	1.08	1.28
15C	359	0.27	22.85
15C	361	0	0.54
15C	363	0.57	6.11
15C	365	0.28	.
15C	366	0	.
15C	367	0	.

Table 9: Raw data for the surveys used in calculating correction factors: dolphin sightings. Transect numbers in Appendix Figures 1-18.

Transect no.	No. of observers		No. of groups of dolphins					
	Port	Starboard		Port			Starboard	
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 1-8, Mackay/Capricorn Section; Blocks 1-4 Central Section								
1	2	2	0	1	0	0	1	3
2	2	2	1	0	0	1	0	0
3	2	2	0	1	0	0	0	1
4	2	2	1	0	0	0	0	0
5	2	2	0	0	0	0	0	0
6	2	2	0	0	0	0	0	0
7	2	2	0	0	0	0	0	0
8	2	2	0	0	0	0	1	0
9	2	2	0	0	0	0	0	0
10	2	2	0	0	0	0	0	0
11	2	2	0	0	0	0	0	0
12	2	2	0	0	0	0	0	0
13	2	2	0	0	0	0	0	0
14	2	2	1	0	0	0	0	0
15	2	2	0	0	0	0	0	0
16	2	2	0	0	0	0	0	0
17	2	2	0	0	0	0	0	0
18	2	2	0	0	0	0	0	0
19	2	2	0	0	0	0	0	0
20	2	2	0	0	0	1	0	0
21	2	2	0	1	0	0	0	0
22	2	2	0	0	0	0	0	0
23	2	2	0	0	0	0	0	0
24	2	2	0	0	1	0	0	0
25	2	2	0	0	0	0	0	0
26	2	2	0	0	0	0	0	0
27	2	2	0	0	0	0	0	0
28	2	2	0	0	0	0	0	0
29	2	2	0	0	0	0	0	0
30	2	2	0	0	0	0	1	0
31	2	2	0	0	0	0	0	0
32	2	2	0	0	0	0	0	0
33	2	2	0	0	0	0	0	0
34	2	2	0	0	0	0	0	0
35	2	2	0	0	0	0	0	0
36	2	2	0	0	0	0	0	0
37	2	2	0	0	0	0	0	0
38	2	2	0	0	0	0	0	0
39	2	2	0	0	0	0	0	0
40	2	2	0	0	0	0	0	0
41	2	2	0	0	0	0	0	0
42	2	2	0	0	0	0	0	0
43	2	2	0	1	0	0	0	0
44	2	2	0	0	0	0	0	0
45	2	2	0	0	0	0	0	0
46	2	2	0	0	0	0	0	0
47	2	2	0	1	0	0	0	0
48	2	2	0	0	0	0	0	0
49	2	2	0	0	0	0	0	0
50	2	2	0	0	0	0	0	0
51	2	2	0	0	0	0	0	0

Transect no.	No. of observers		No. of groups of dolphins					
	Port	Starboard		Port			Starboard	
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 1-8, Mackay/Capricorn Section; Blocks 1-4 Central Section								
52	2	2	0	0	0	0	1	0
53	2	2	0	0	0	0	0	0
54	2	2	0	0	0	1	0	1
55	2	2	0	0	0	0	0	0
56	2	2	0	0	0	0	0	0
57	2	2	0	0	0	0	0	0
58	2	2	0	0	0	0	1	0
59	2	2	0	0	0	0	0	0
60	2	2	0	0	0	0	0	0
61	2	2	0	0	0	0	0	0
62	2	2	0	0	0	0	0	0
63	2	2	0	0	0	0	0	0
64	2	2	0	0	0	0	0	0
68	2	2	0	0	0	0	0	0
70	2	2	0	0	0	0	0	1
71	2	2	0	0	0	0	0	0
72	2	2	0	0	0	0	0	0
73	2	2	0	0	0	0	0	0
74	2	2	0	0	0	0	0	0
75	2	2	0	0	0	0	0	0
76	2	2	0	0	0	0	0	0
77	2	2	0	0	0	0	0	0
78	2	2	0	0	0	0	0	0
80	2	2	0	0	0	0	0	0
81	2	2	0	0	0	0	0	0
82	2	2	0	0	1	0	0	0
83	2	2	0	0	0	0	0	0
84	2	2	0	0	0	0	0	0
85	2	2	0	0	0	0	0	0
86	2	2	0	0	0	0	0	0
87	2	2	0	0	0	0	0	1
88	2	2	0	0	0	0	0	0
89	2	2	0	0	0	0	0	0
90	2	2	0	0	0	0	0	0
91	2	2	0	0	0	0	0	0
92	2	2	0	0	0	0	0	0
93	2	2	0	0	0	0	0	0
94	2	2	0	0	0	0	0	0
95	2	2	0	0	0	0	0	0
96	2	2	0	0	0	0	0	0
97	2	2	0	0	0	0	0	0
98	2	2	0	0	0	0	0	0
99	2	2	0	0	0	0	0	0
100	2	2	0	0	0	0	0	0
101	2	2	0	0	0	0	0	0
102	2	2	0	0	0	0	0	0
103	2	2	0	0	0	0	0	0
104	2	2	0	0	0	0	0	0
105	2	2	0	0	0	0	0	0
106	2	2	0	0	0	0	0	0
107	2	2	0	0	0	0	0	0
108	2	2	0	0	0	0	0	0
109	2	2	0	0	0	0	0	0
110	2	2	0	0	0	0	0	0

Transect no.	No. of observers		No. of groups of dolphins					
	Port	Starboard	Port			Starboard		
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 1-8, Mackay/Capricorn Section; Blocks 1-4 Central Section								
111	2	2	0	0	0	0	0	0
112	2	2	0	0	0	0	0	0
113	2	2	0	0	0	0	0	0
114	2	2	0	0	0	0	0	0
115	2	2	0	0	0	0	0	0
116	2	2	0	1	0	0	0	0
117	2	2	0	0	0	0	0	0
118	2	2	0	0	0	0	0	0
119	2	2	0	0	0	0	0	0
120	2	2	0	0	0	0	0	0
121	2	2	0	0	0	0	0	0
122	2	2	0	0	0	0	0	0
123	2	2	0	0	0	0	0	0
124	2	2	0	0	0	1	0	0
125	2	2	0	0	0	0	0	0
126	2	2	0	0	0	0	0	0
127	2	2	0	0	0	0	0	0
128	2	2	0	0	0	0	0	0
129	2	2	0	0	0	0	0	0
130	2	2	0	0	2	0	2	1
131	2	2	0	0	1	1	0	0
132	2	2	0	0	0	0	0	1
133	2	2	0	0	0	0	0	1
134	2	2	0	0	0	0	0	0
135	2	2	0	0	0	0	0	0
136	2	2	1	0	0	0	1	0
137	2	2	0	0	0	2	0	0
138	2	2	0	0	0	0	0	0
139	2	2	0	0	0	0	0	0
140	2	2	0	0	0	0	0	0
141	2	2	0	0	0	0	0	0
142	2	2	1	0	0	0	0	0
143	2	2	0	0	1	0	0	0
139a	2	2	0	0	0	0	0	1
140a	2	2	0	0	0	0	0	1
141a	2	2	1	0	0	0	0	1
142a	2	2	0	0	0	0	0	0
143a	2	2	0	0	0	0	0	0
144	2	2	0	0	0	0	0	0
145	2	2	0	0	0	0	0	0
146	2	2	0	0	0	0	0	0
147	2	2	0	0	0	0	0	0
148	2	2	1	0	1	0	0	0
149	2	2	0	0	0	0	0	0
150	2	2	0	0	0	0	0	0
151	2	2	0	0	0	0	0	0
152	2	2	0	0	0	0	0	1
153	2	2	0	0	0	0	0	0
154	2	2	0	0	0	0	0	0
155	2	2	0	0	0	0	0	0
156	2	2	0	0	0	0	0	0
157	2	2	0	0	0	0	0	0
158	2	2	0	0	0	0	0	0
159	2	2	0	0	0	0	0	0

Transect no.	No. of observers		No. of groups of dolphins					
	Port	Starboard	Port			Starboard		
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 1-8, Mackay/Capricorn Section; Blocks 1-4 Central Section								
160	2	2	0	1	0	0	0	2
161	2	2	0	0	0	0	0	1
162	2	2	0	0	0	0	0	0
163	2	2	0	0	0	0	0	0
164	2	2	0	0	0	0	0	0
165	2	2	0	0	0	0	0	0
166	2	2	0	0	0	0	0	0
167	2	2	0	0	0	0	0	0
168	2	2	0	0	0	0	0	0
169	2	2	0	0	0	0	0	0
171	2	2	1	0	0	0	0	1
172	2	2	0	0	0	0	0	0
173	2	2	0	0	0	0	0	0
174	2	2	0	0	0	0	0	1
175	2	2	0	0	0	0	0	0
177	2	2	0	0	0	0	0	0
178	2	2	0	0	0	0	0	0
179	2	2	0	0	0	0	0	1
180	2	2	0	0	0	0	0	0
182	2	2	0	0	0	0	0	0
184	2	2	0	0	0	0	0	0
185	2	2	0	0	0	0	0	0
187	2	2	0	0	0	0	0	0
189	2	2	0	0	0	0	0	0
190	2	2	0	0	0	0	0	1
191	2	2	0	0	0	0	0	0
192	2	2	0	0	0	0	0	0
193	2	2	0	0	0	0	0	0
194	2	2	0	0	0	0	0	0
195	2	2	0	0	0	0	0	0
196	2	2	0	0	0	0	0	0
197	2	2	0	0	0	0	0	0
198	2	2	0	0	0	0	0	0
			8	7	7	7	8	21

Transect no.	No. of observers		No. of groups of dolphins					
	Port	Starboard		Port			Starboard	
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 5-15, Central Section and Cairns Section								
199	1	1	0	0	0	0	0	0
200	1	1	0	0	0	0	0	0
201	1	1	0	0	0	0	0	0
202	1	1	1	0	0	0	0	0
203	1	1	0	0	0	0	0	0
204	1	1	0	0	0	0	0	0
205	1	1	0	0	0	0	0	0
206	1	1	0	0	0	0	0	0
207	1	1	0	0	0	0	0	0
208	1	1	0	0	0	0	0	0
209	1	1	0	0	0	0	0	0
210	1	1	0	0	0	1	0	0
211	1	1	1	0	0	0	0	0
212	1	1	0	0	0	2	0	0
213	1	1	0	0	0	1	0	0
214	1	1	0	0	0	0	0	0
215	1	1	0	0	0	0	0	0
216	1	1	0	0	0	0	0	0
217	1	1	0	0	0	0	0	0
218	1	1	0	0	0	0	0	0
219	1	1	1	0	0	0	0	0
220	1	1	0	0	0	0	0	0
221	1	1	1	0	0	0	0	0
222	1	1	0	0	0	0	0	0
223	2	1	0	0	0	0	0	0
224	2	1	0	0	0	0	0	0
225	2	1	0	0	0	0	0	0
226	2	1	0	0	0	0	0	0
227	2	1	0	0	0	1	0	0
228	2	1	0	0	0	0	0	0
229	2	1	0	0	0	0	0	0
230	1	1	0	0	0	0	0	0
231	1	1	0	0	0	0	0	0
232	2	1	0	0	0	0	0	0
233	2	1	0	0	0	0	0	0
234	2	1	0	0	0	0	0	0
235	2	1	0	0	0	0	0	0
236	2	1	0	0	0	0	0	0
237	2	1	0	0	1	0	0	1
238	2	1	0	0	0	0	0	0
239	2	1	0	0	1	0	1	0
240	2	1	0	0	0	0	0	0
241	2	1	0	0	0	0	0	0
242	2	1	0	0	0	1	0	0
243	2	1	0	0	0	0	0	0
244	2	1	0	0	0	0	0	0
245	2	1	0	0	0	0	0	0
246	2	2	0	0	0	0	0	0
247	2	2	0	0	0	0	0	0
248	2	2	0	0	0	0	0	0
249	2	2	0	0	0	0	0	0
250	2	2	0	2	0	0	0	0

Transect no.	No. of observers		No. of groups of dolphins					
	Port	Starboard		Port			Starboard	
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 5-15, Central Section and Cairns Section								
251	2	2	0	0	0	0	1	0
252	2	2	0	0	0	0	0	0
253	2	2	0	0	0	1	0	0
254	2	2	0	0	1	0	0	0
255	2	2	0	0	0	0	0	0
256	2	2	0	0	1	0	0	0
257	2	2	0	0	0	0	0	0
258	2	2	0	0	0	0	0	0
258	2	2	0	1	0	0	0	0
259	2	2	0	0	0	0	0	0
260	2	2	0	0	0	0	1	1
261	2	2	0	0	0	0	0	0
262	2	2	0	0	0	0	0	1
263	2	2	0	0	0	0	0	0
265	2	2	0	0	0	0	0	0
266	2	2	0	0	0	0	0	0
267	2	2	0	0	0	0	0	1
268	2	2	0	1	1	0	0	0
269	2	2	0	0	0	0	0	0
270	2	2	0	0	1	0	0	0
271	2	2	0	0	0	0	0	0
273	2	2	0	0	0	0	0	0
274	2	2	0	0	1	1	0	0
275	2	2	0	0	0	0	0	0
276	2	2	0	0	0	0	0	0
277	2	2	0	0	0	0	0	0
278	2	2	0	0	0	0	0	0
279	2	2	0	0	0	0	0	0
280	2	2	0	0	0	0	0	0
281	2	2	0	0	0	0	0	0
282	2	2	0	0	0	0	0	0
283	2	2	0	0	0	0	0	0
284	2	2	0	0	2	0	0	1
285	2	2	0	0	0	0	0	1
286	2	2	0	1	0	0	0	0
287	2	2	0	0	0	0	0	0
288	2	2	0	0	0	1	0	0
289	2	2	0	0	0	0	0	0
290	2	2	0	0	0	0	0	1
291	2	2	0	0	0	0	0	0
292	2	2	0	0	0	0	0	0
293	2	2	0	0	0	0	0	0
294	2	2	0	0	0	0	0	1
295	2	2	0	0	0	0	0	1
296	2	2	0	0	0	0	0	0
297	2	2	1	1	1	0	0	0
298	2	2	0	0	2	0	0	0
299	2	2	0	0	0	0	0	2
300	2	2	0	0	0	0	0	0
301	2	2	0	0	0	0	0	1
302	2	2	0	0	0	1	0	0
303	2	2	0	0	0	0	0	2
304	2	2	0	0	0	0	0	0
305	2	2	0	0	0	0	0	1

Transect no.	No. of observers		No. of groups of dolphins					
	Port	Starboard	Mid	Port Rear	Tandem	Mid	Starboard Rear	Tandem
Blocks 5-15, Central Section and Cairns Section								
306	2	2	0	1	1	0	0	0
307	2	2	0	0	0	0	0	0
308	2	2	1	0	1	0	0	0
309	2	2	0	0	0	0	0	0
310	2	2	0	0	1	0	0	0
311	2	2	0	0	0	0	1	0
312	2	2	0	0	0	0	0	0
313	2	2	0	0	0	0	0	0
314	2	2	0	0	0	0	0	0
315	2	2	0	0	0	0	0	0
316	2	2	0	0	0	0	0	0
317	2	2	0	0	0	0	0	0
318	2	2	0	0	0	0	0	0
319	2	2	0	0	0	0	0	0
320	2	2	0	0	0	0	0	0
321	2	2	0	0	0	0	0	0
322	2	2	0	0	0	0	0	0
323	2	2	0	0	0	0	0	0
324	2	2	0	0	0	0	0	0
325	2	2	0	0	1	0	0	1
326	2	2	0	0	0	0	0	1
327	2	2	0	0	0	0	0	1
328	2	2	0	0	0	1	0	0
329	2	2	0	0	1	0	0	1
330	2	2	0	0	1	0	0	1
331	2	2	0	0	0	0	0	0
332	2	2	0	0	0	0	1	0
333	2	2	1	0	0	0	0	1
334	2	2	0	0	0	0	0	0
335	2	2	0	0	0	0	0	1
336	2	2	0	0	0	0	0	0
337	2	2	0	0	0	1	0	1
338	2	2	0	0	0	1	0	1
339	2	2	0	1	0	0	0	0
340	2	2	0	0	0	0	0	0
341	2	2	1	0	0	0	0	0
342	2	2	0	1	0	0	0	0
343	2	2	0	0	0	0	1	0
344	2	2	0	0	1	0	0	0
345	2	2	0	0	0	0	0	0
346	2	2	0	0	0	0	0	0
347	2	2	0	0	0	0	0	0
348	2	2	0	0	0	0	0	0
349	2	2	0	0	0	0	0	0
350	2	2	0	0	1	0	0	0
351	2	1	0	0	1	0	0	0
352	2	1	0	0	0	0	0	0
353	2	2	0	0	0	1	0	0
354	2	1	0	0	1	1	0	0
355	2	2	0	1	0	0	0	1
356	2	2	0	0	0	1	0	0
357	2	2	0	0	0	0	0	0
358	2	2	0	0	0	0	0	0
359	2	2	0	0	1	0	0	0

Transect no.	No. of observers		No. of groups of dolphins					
	Port	Starboard	Port			Starboard		
			Mid	Rear	Tandem	Mid	Rear	Tandem
Blocks 5-15, Central Section and Cairns Section								
360	2	2	1	0	0	0	0	0
361	2	2	0	0	0	0	2	0
362	2	2	0	0	0	0	0	0
364	2	2	0	0	0	0	0	0
			9	10	23	16	8	25

Table 10: Raw data used to calculate correction factors for dolphins for each survey or subsection of survey.

Correction for perception bias (Note: there was no correction for availability bias).

Blocks	No. of groups of dolphins					
	Port			Starboard		
	mid-seat	rear-seat	tandem	mid-seat	rear-seat	tandem
1-8: Mackay/Capricorn Section						
1-4: Central Section	12	14	21	13	16	29
5-15: Central Section and Cairns Section	10	10	23	17	8	25

Table 11: Raw data for the analysis of variance and covariance: dolphin sightings.

Block	Transect no.	Corrected density of dolphins 1986/1987	Corrected density of dolphins 1992
Mackay/Capricorn Section			
1S	10	0.30	0.00
1S	11	0.30	0.00
1S	12	0.30	0.00
1S	13	0.29	0.00
1S	17	0.27	0.00
1S	1	0.30	1.82
1S	2	0.00	3.37
1S	3	0.29	1.12
1S	4	0.30	0.59
1S	5	1.20	0.00
1S	6	1.20	0.00
1S	7	1.52	0.00
1S	8	0.58	0.72
1S	9	0.24	0.00
2S	23	0.00	0.00
2S	25	0.28	0.00
2S	27	0.00	0.00
2S	29	0.30	0.00
2S	30	0.00	0.37
2S	31	0.00	0.00
2S	32	0.28	0.00
2S	33	0.00	0.00
2S	34	0.00	0.00
3S	11	0.00	0.00
3S	14	0.00	1.73
3S	15	0.00	0.00
3S	16	0.34	0.00
3S	18	0.32	0.00
3S	20	0.00	0.59
3S	12	0.00	0.00
3S	22	0.72	0.00
3S	24	0.00	0.47
3S	26	0.00	.
3S	35	0.00	0.00
3S	37	0.28	0.00
3S	39	0.00	0.00
3S	41	0.00	.
3S	13	0.00	0.00
3S	17	0.00	0.00
3S	19	0.00	0.00
3S	21	0.70	0.60
3S	23	0.00	0.00
3S	25	0.00	0.00
3S	27	0.00	0.00
3S	34	0.00	.
3S	36	0.00	0.00
3S	38	0.00	0.00
3S	40	0.00	0.00
3S	42	0.00	0.00
4S	43	0.40	0.43

Block	Transect no.	Corrected density of dolphins 1986/1987	Corrected density of dolphins 1992
Mackay/Capricorn Section			
4S	44	0.00	0.00
4S	45	0.00	0.00
4S	46	0.00	0.00
4S	47	0.28	0.34
4S	48	0.00	0.27
4S	49	0.00	0.00
4S	50	0.00	0.00
4S	51	0.28	0.00
4S	52	0.00	1.07
4S	53	0.29	0.00
4S	54	0.00	3.21
4S	55	0.30	0.00
4S	56	0.29	0.00
4S	57	0.00	0.00
4S	58	0.00	0.36
4S	59	0.00	0.00
4S	60	0.00	0.00
4S	61	0.00	0.00
4S	62	0.00	0.00
4S	63	0.00	0.00
4S	64	0.00	0.00
4S	70	0.00	2.57
4S	71	0.00	0.00
4S	72	0.00	.
4S	74	0.00	.
4S	76	0.38	.
4S	77	0.29	.
4S	78	0.00	.
4S	98	0.00	.
5S	80	.	0.00
5S	68	0.00	0.00
5S	73	0.00	0.00
5S	75	0.00	0.00
5S	81	0.00	.
5S	67	0.00	0.00
5S	69	0.00	0.00
5S	62	0.00	.
5S	63	0.00	0.00
5S	70	0.00	6.55
5S	72	0.00	0.00
5S	74	0.00	0.00
5S	76	0.00	0.00
5S	82	0.00	0.99
5S	83	0.00	0.00
5S	84	0.00	0.00
5S	85	0.00	0.00
5S	86	0.00	0.00
5S	87	0.00	0.37
5S	88	0.00	0.00
5S	89	0.00	0.00
5S	90	0.00	0.00
5S	91	0.00	0.00
5S	92	0.00	0.00

Block	Transect no.	Corrected density of dolphins 1986/1987	Corrected density of dolphins 1992
Mackay/Capricorn Section			
5S	93	0.00	0.00
5S	94	0.00	0.00
5S	95	0.20	0.00
5S	96	0.00	0.00
5S	97	0.00	0.00
5S	98	0.00	0.00
6S	123	0.33	0.00
6S	124	0.00	0.18
6S	125	0.00	0.00
6S	126	0.00	0.00
6S	127	0.00	0.00
6S	128	0.00	0.00
6S	129	0.31	0.00
6S	99	0.00	0.00
6S	100	.	0.00
6S	101	.	0.00
6S	102	.	0.00
6S	103	.	0.00
6S	104	0.00	0.00
6S	105	0.00	0.00
6S	106	0.00	0.00
6S	107	0.00	0.00
6S	108	0.00	0.00
6S	109	0.18	0.00
6S	110	0.00	0.00
6S	111	0.00	0.00
6S	112	0.00	0.00
6S	113	0.06	0.00
6S	114	0.00	0.00
6S	115	0.00	0.00
6S	116	0.00	0.25
6S	117	0.10	0.00
6S	118	0.00	0.00
6S	119	0.00	0.00
6S	120	0.00	0.00
6S	121	0.00	0.00
6S	122	0.00	0.00
7S	130	0.17	2.77
7S	131	0.17	0.55
7S	132	0.00	2.44
7S	133	0.28	1.74
7S	134	0.00	0.00
7S	135	0.00	0.00
7S	136	0.00	0.99
7S	137	0.00	3.31
7S	138	0.00	0.00
7S	139	0.58	0.00
7S	139a	.	0.92
8S	140	0.58	0.00
8S	140a	.	0.94
8S	141	0.58	0.00
8S	141a	.	3.28
8S	142	0.59	0.75

Block	Transect no.	Corrected density of dolphins 1986/1987	Corrected density of dolphins 1992
Mackay/Capricorn Section			
8S	142a	.	0.00
8S	143	0.00	0.38
8S	143a	.	0.00
8S	144	0.00	0.00
8S	145	0.28	0.00
8S	146	0.30	0.00
8S	147	0.58	0.00
Central Section			
1C	148	0.67	4.55
1C	149	0.31	0.00
1C	150	0.00	0.00
1C	151	0.00	0.00
1C	152	1.33	0.59
1C	153	0.43	0.00
1C	154	0.00	0.00
1C	155	0.00	0.00
1C	156	0.00	0.00
2C	170	0.00	0.00
2C	171	0.64	1.17
2C	172	0.31	0.00
2C	173	0.32	0.00
2C	174	0.32	0.39
2C	175	0.32	0.00
2C	176	0.00	0.00
3C	157	0.00	0.00
3C	158	0.00	0.00
3C	161	0.00	1.38
3C	162	0.00	0.00
3C	163	0.00	0.00
3C	164	0.39	0.00
3C	165	0.00	0.00
3C	166	0.79	0.00
3C	167	0.00	0.00
3C	168	0.00	0.00
3C	169	0.00	0.00
3C	177	0.00	0.00
3C	178	0.00	0.00
3C	179	0.00	0.42
3C	180	0.34	0.00
3C	181	0.00	.
3C	182	0.00	0.00
3C	183	0.19	.
3C	184	0.86	0.00
3C	185	1.75	0.00
3C	186	0.00	.
3C	187	0.00	4.80
3C	188	0.00	.
4C	189	0.00	0.00
4C	190	0.00	1.31
4C	191	0.00	0.00
4C	192	0.00	0.00
4C	193	0.00	0.00
4C	194	0.27	0.00

Block	Transect no.	Corrected density of dolphins 1986/1987	Corrected density of dolphins 1992
Central Section			
4C	195	0.00	0.00
4C	196	0.34	0.00
4C	197	0.00	0.00
4C	198	0.29	0.00
5C	199	0.00	0.00
5C	200	0.00	0.00
5C	201	0.00	0.00
5C	202	0.31	0.80
5C	203	0.00	0.00
5C	204	0.00	0.00
5C	205	0.00	0.00
5C	213	0.00	0.37
5C	214	1.26	0.00
5C	215	0.62	0.00
5C	216	0.00	0.00
5C	217	0.00	0.00
5C	218	0.59	0.00
5C	219	0.30	0.41
5C	220	0.00	0.00
5C	221	1.16	1.62
5C	222	0.00	0.00
5C	230	0.00	0.00
5C	231	0.00	0.00
6C	206	0.00	0.00
6C	207	0.00	0.00
6C	208	0.00	0.00
6C	209	0.00	0.00
6C	210	0.00	0.50
6C	211	0.00	0.49
6C	212	0.00	0.97
7C	223	0.00	0.00
7C	224	0.00	0.00
7C	225	0.00	0.00
7C	226	0.00	0.00
7C	227	0.00	0.21
7C	228	0.18	0.00
7C	229	0.00	0.00
8C	240	0.33	0.00
8C	232	0.00	0.00
8C	233	0.00	0.00
8C	234	0.00	0.00
8C	235	0.00	0.00
8C	243	1.36	0.00
8C	236	0.00	0.00
8C	239	0.00	1.85
8C	241	0.00	0.00
8C	237	0.00	0.83
8C	242	0.70	0.40
8C	244	0.00	0.00
8C	238	0.00	0.00
9C	245	0.34	0.00
9C	246	0.31	0.00
9C	247	0.46	0.00

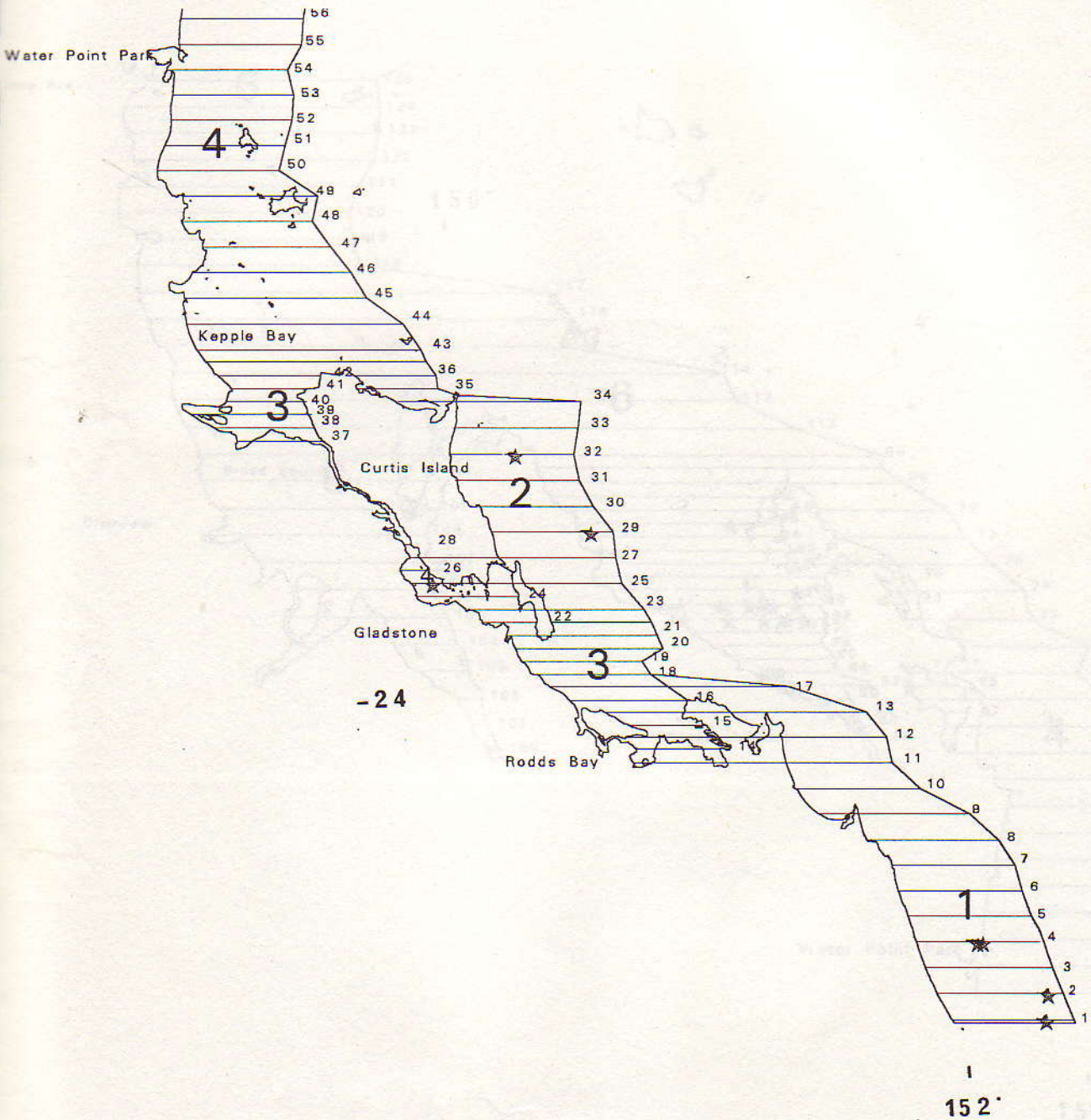
Block	Transect no.	Corrected density of dolphins 1986/1987	Corrected density of dolphins 1992
Central Section			
9C	248	0.13	0.00
9C	249	0.28	0.00
9C	250	0.00	0.26
9C	251	0.00	0.55
9C	252	0.18	0.00
9C	259	0.00	0.00
9C	260	0.62	0.45
9C	261	0.00	0.00
9C	262	0.00	1.36
9C	263	0.00	0.00
9C	258	0.93	0.00
9C	253	1.09	0.30
9C	254	0.00	3.89
9C	255	0.67	0.00
9C	256	1.01	0.90
9C	257	0.00	0.00
9C	258	0.86	1.80
9C	265	0.00	0.00
9C	266	0.00	0.00
9C	267	0.00	1.19
9C	268	0.00	0.90
9C	269	0.00	0.00
9C	270	0.00	0.30
9C	271	0.00	0.00
9C	282	0.00	0.00
10C	272	0.00	0.00
10C	273	0.00	0.00
10C	274	0.00	0.44
10C	275	0.00	0.00
10C	276	0.00	0.00
10C	277	0.00	0.00
10C	278	.	0.00
10C	279	0.00	0.00
10C	280	0.00	0.00
10C	281	0.00	0.00
11C	283	0.79	0.00
11C	284	0.18	1.25
11C	285	0.23	0.46
11C	286	0.00	1.20
11C	287	0.00	0.00
11C	288	0.00	1.51
11C	289	0.00	0.00
11C	290	0.00	0.30
11C	291	0.00	0.00
11C	292	1.20	0.00
11C	293	0.85	0.00
11C	294	0.00	0.61
Cairns Section			
12C	295	0.00	0.30
12C	296	0.34	0.00
12C	297	0.87	0.41
12C	298	0.30	1.86
12C	299	0.59	0.74

Block	Transect no.	Corrected density of dolphins 1986/1987	Corrected density of dolphins 1992
Cairns Section			
12C	300	0.00	0.00
12C	301	0.00	0.18
12C	302	0.21	1.91
12C	303	0.00	0.55
12C	304	0.00	0.00
12C	305	0.00	0.75
12C	306	0.19	1.31
12C	307	0.31	0.00
12C	308	0.00	0.90
12C	309	0.00	0.00
12C	310	0.00	0.61
12C	311	0.00	0.30
12C	312	0.00	0.00
12C	313	0.00	0.00
12C	314	0.00	0.00
12C	315	0.23	0.00
12C	316	0.19	0.00
12C	317	0.21	0.00
12C	318	0.00	0.00
12C	319	0.21	0.00
12C	325	0.00	0.99
13C	326	0.25	1.21
13C	327	0.46	2.58
13C	328	0.41	2.34
13C	329	0.59	1.29
13C	330	0.50	0.80
13C	331	0.51	0.00
13C	332	0.63	0.12
13C	333	0.13	0.49
13C	334	0.23	0.00
13C	320	1.79	.
14C	335	0.16	0.44
14C	336	0.16	0.00
14C	337	0.28	0.25
14C	338	0.00	0.38
14C	339	0.00	0.28
14C	340	0.16	0.00
14C	341	0.00	0.14
14C	342	0.00	0.14
14C	343	0.17	0.16
14C	344	0.70	0.16
14C	345	0.16	0.00
14C	346	0.16	0.00
14C	347	0.00	0.00
14C	348	0.00	0.00
14C	349	0.15	0.00
14C	350	0.00	0.14
14C	351	0.30	0.69
14C	352	0.00	0.00
14C	353	0.73	0.14
14C	354	0.13	0.27
14C	355	0.13	0.26
14C	356	0.00	0.13

Block	Transect no.	Corrected density of dolphins 1986/1987	Corrected density of dolphins 1992
Cairns Section			
15C	357	0.00	0.00
15C	359	0.00	0.90
15C	361	0.31	0.60
15C	363	0.33	0.00
15C	365	0.00	.
15C	366	0.00	.
15C	367	0.00	.

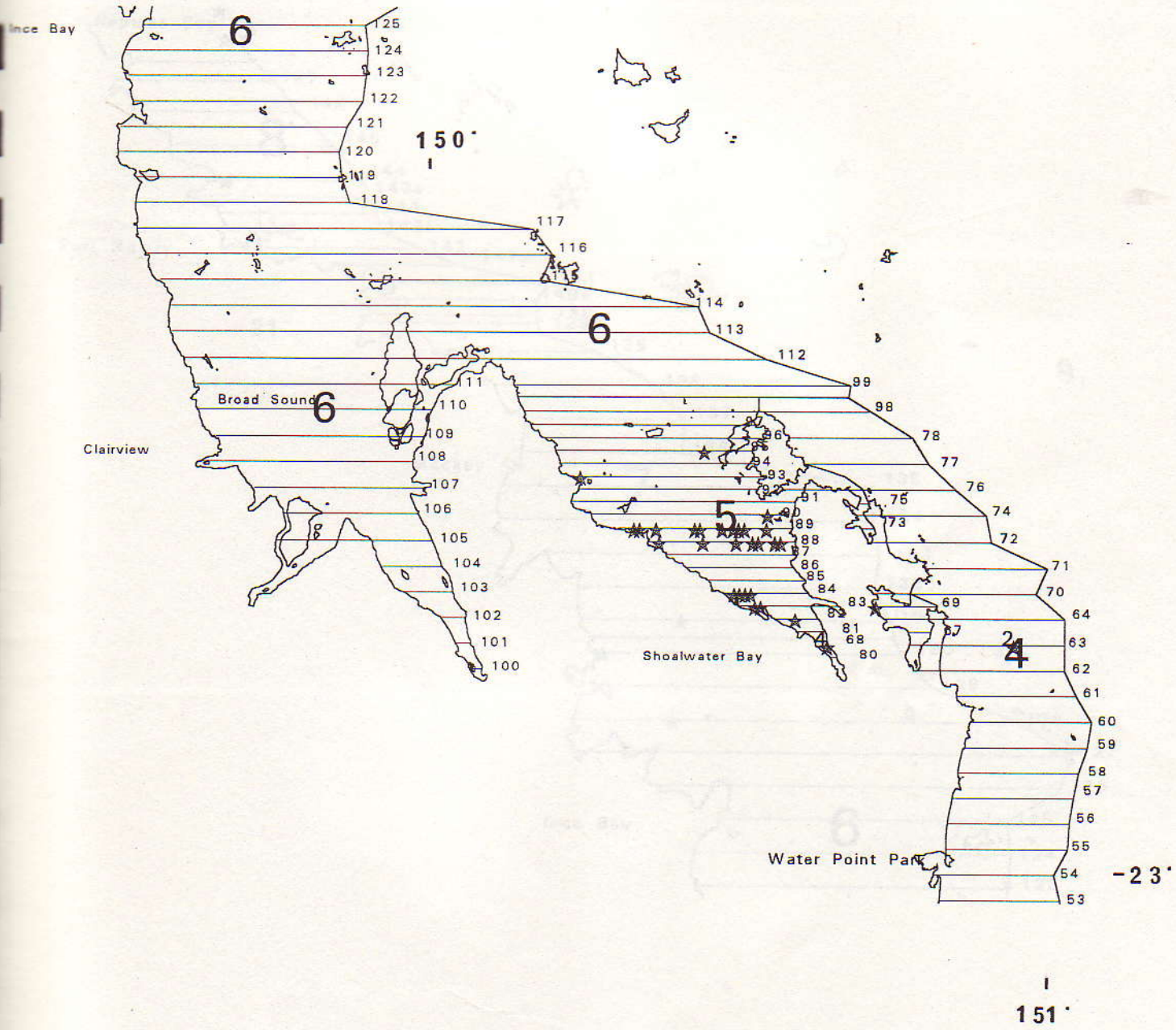
APPENDIX
FIGURES

APPENDIX
FIGURES

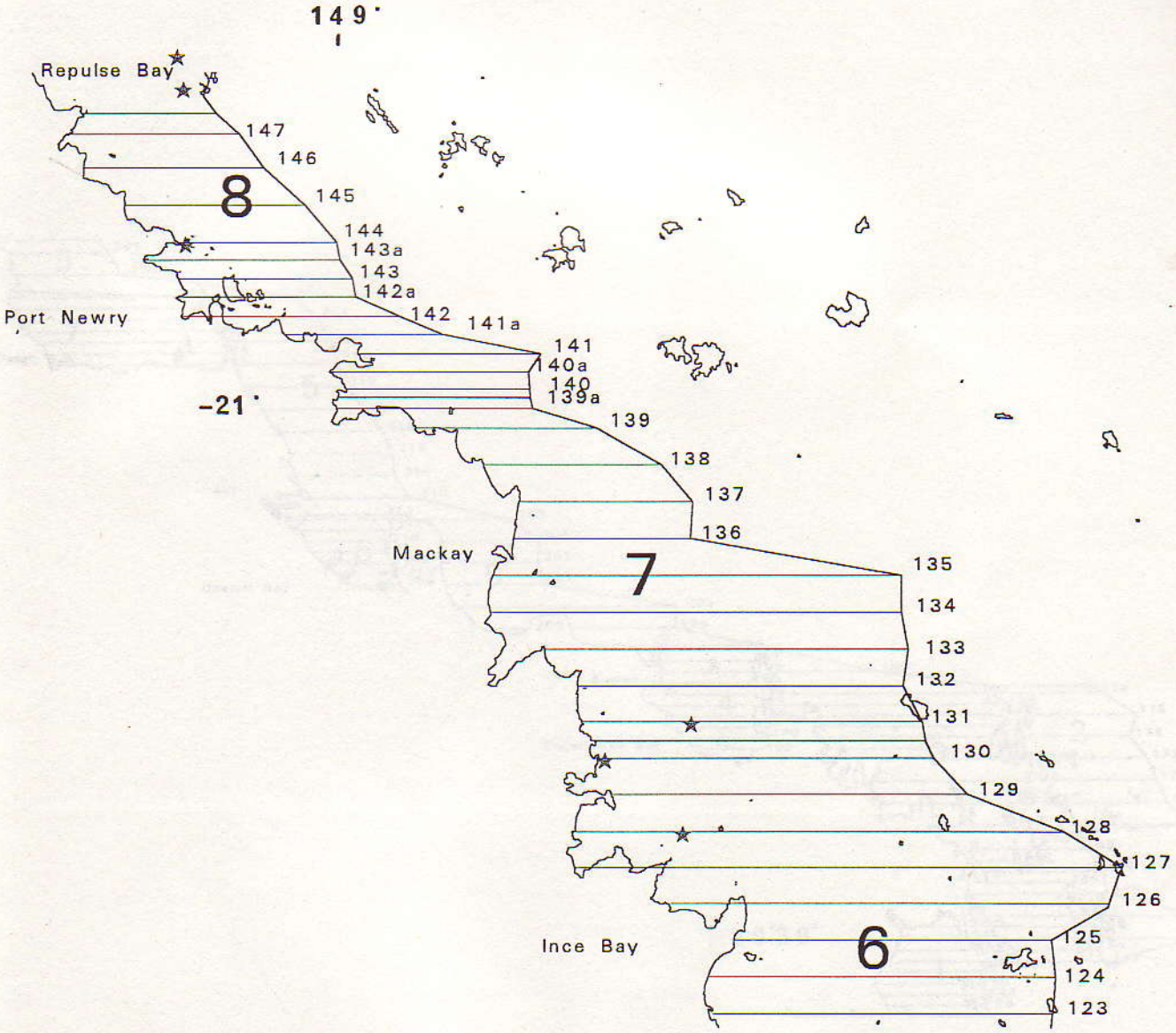


Appendix Figures

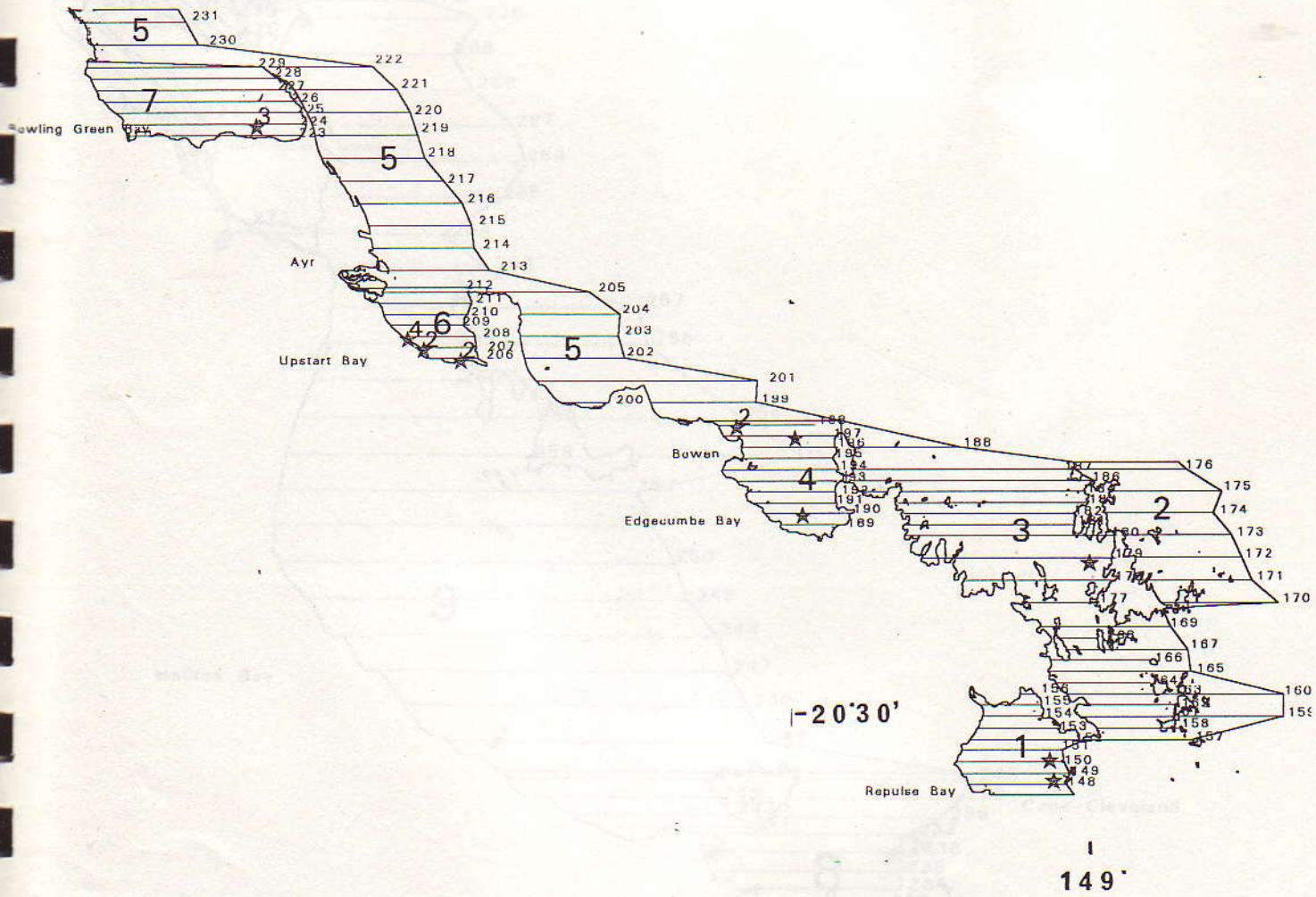
Appendix Figure 1: Survey area from Water Park Point to Rodds Bay (Mackay-Capricorn Section) showing the transect numbers and positions of dugong sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



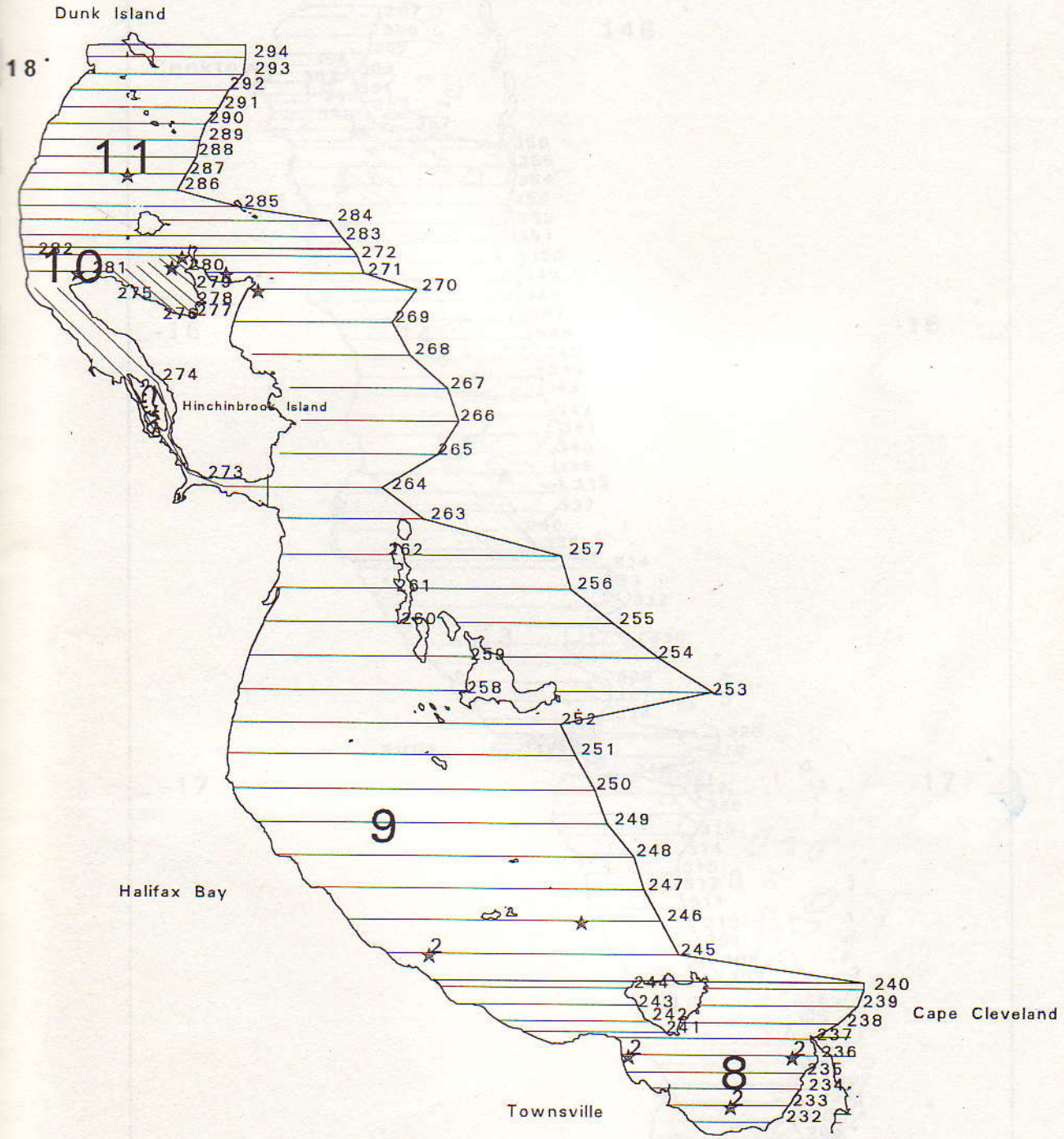
Appendix Figure 2: Survey area from Ince Bay to Water Park Point (Mackay-Capricorn Section) showing the transect numbers and positions of dugong sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



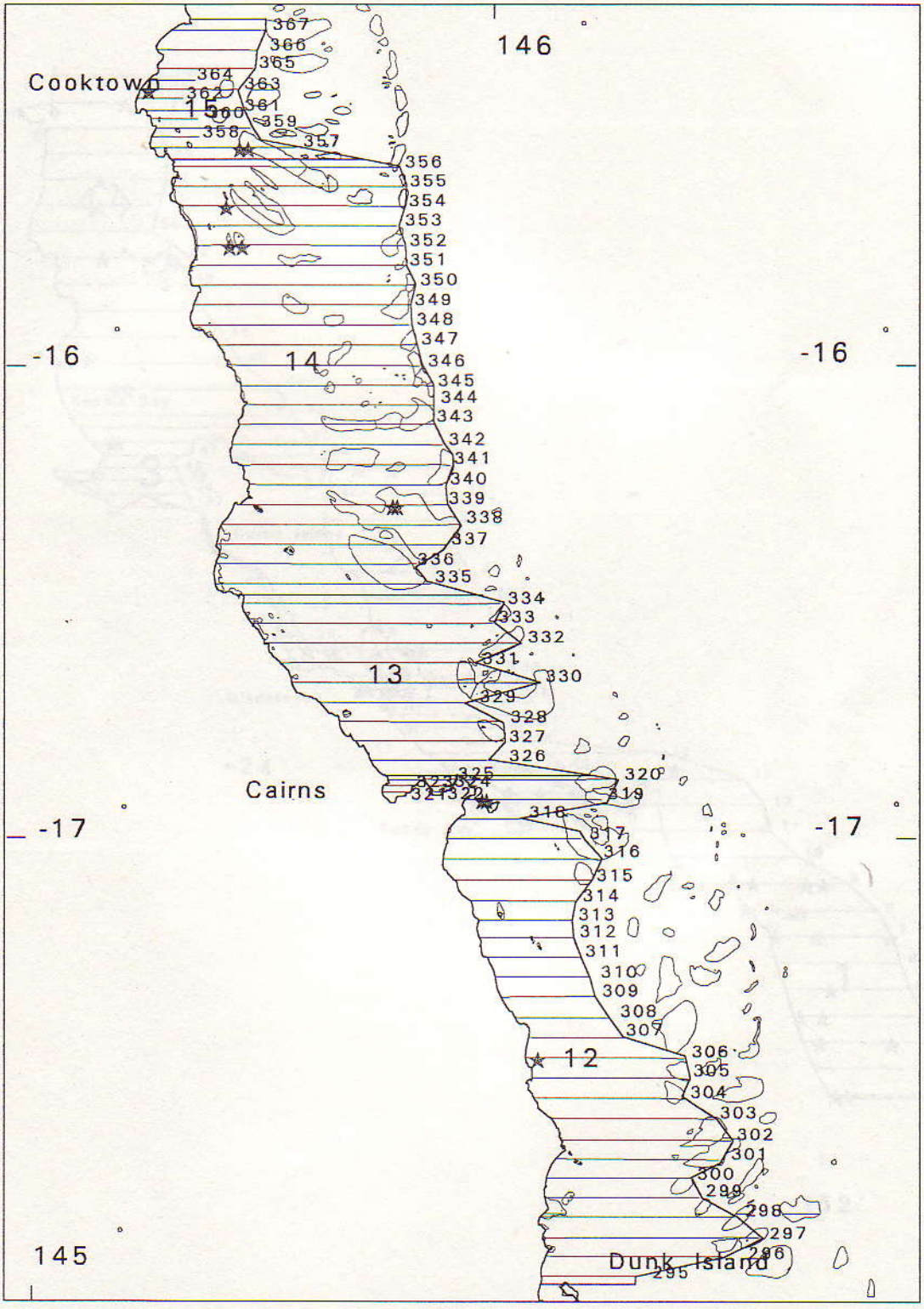
Appendix Figure 3: Survey area from Repulse Bay to Ince Bay (Mackay-Capricorn Section) showing the transect numbers and positions of dugong sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



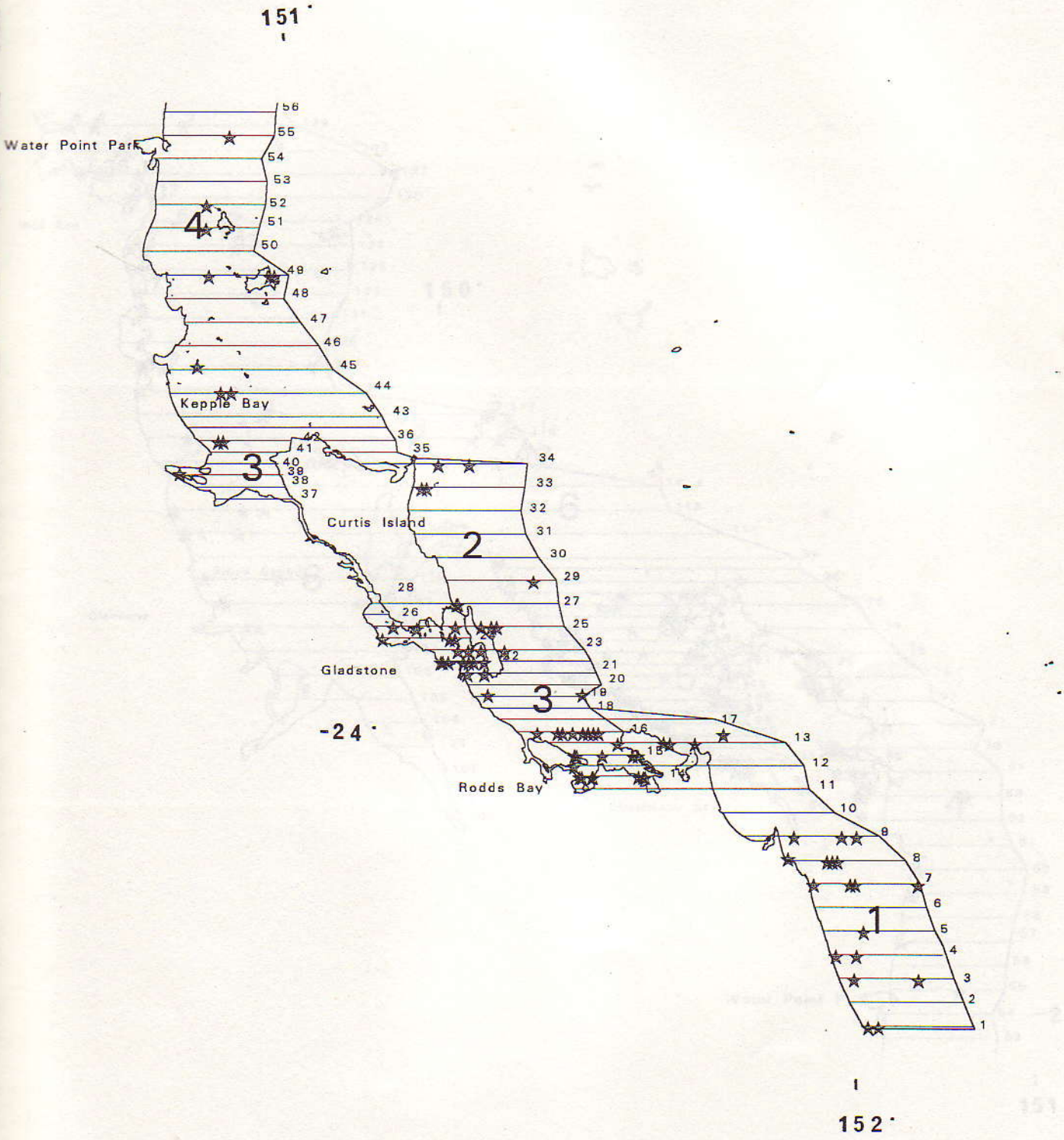
Appendix Figure 4: Survey area from Cape Cleveland to Repulse Bay (southern Central Section) showing the transect numbers and positions of dugong sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



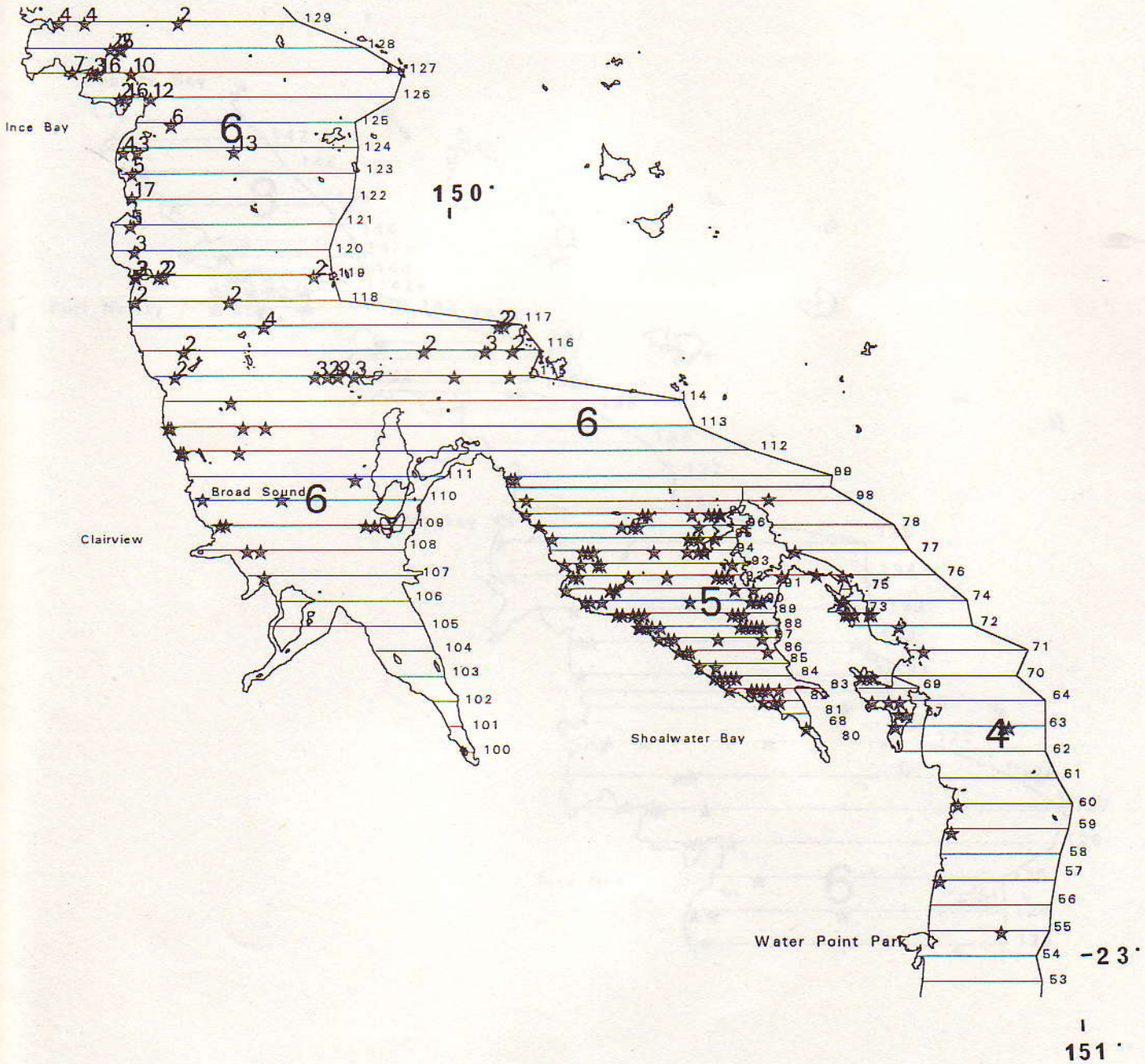
Appendix Figure 5: Survey area from Dunk Island to Cape Cleveland (northern Central Section) showing the transect numbers and positions of dugong sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



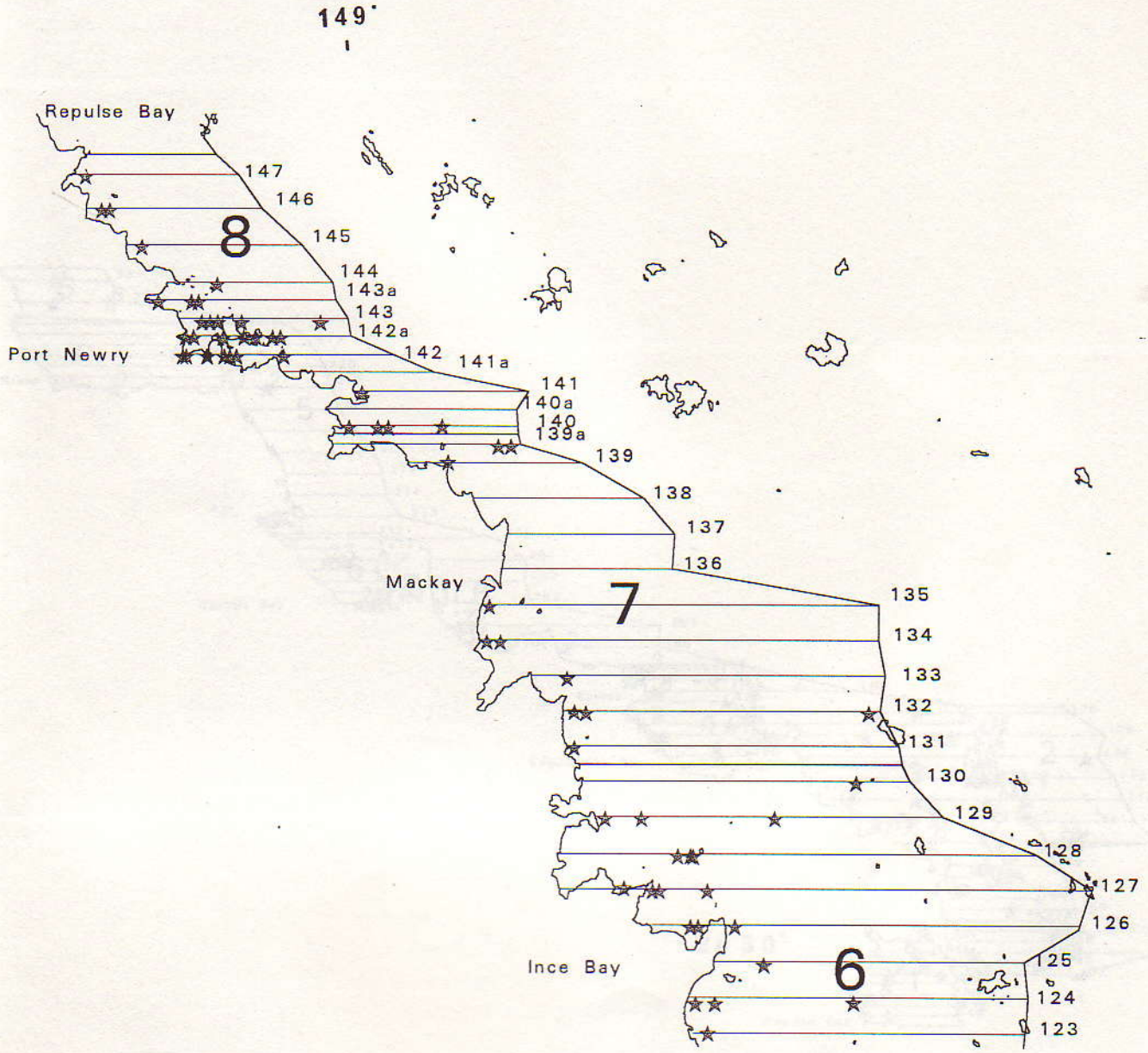
Appendix Figure 6: Survey area from Cape Bedford to Dunk Island Cairns Section) showing the transect numbers and positions of dugong sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



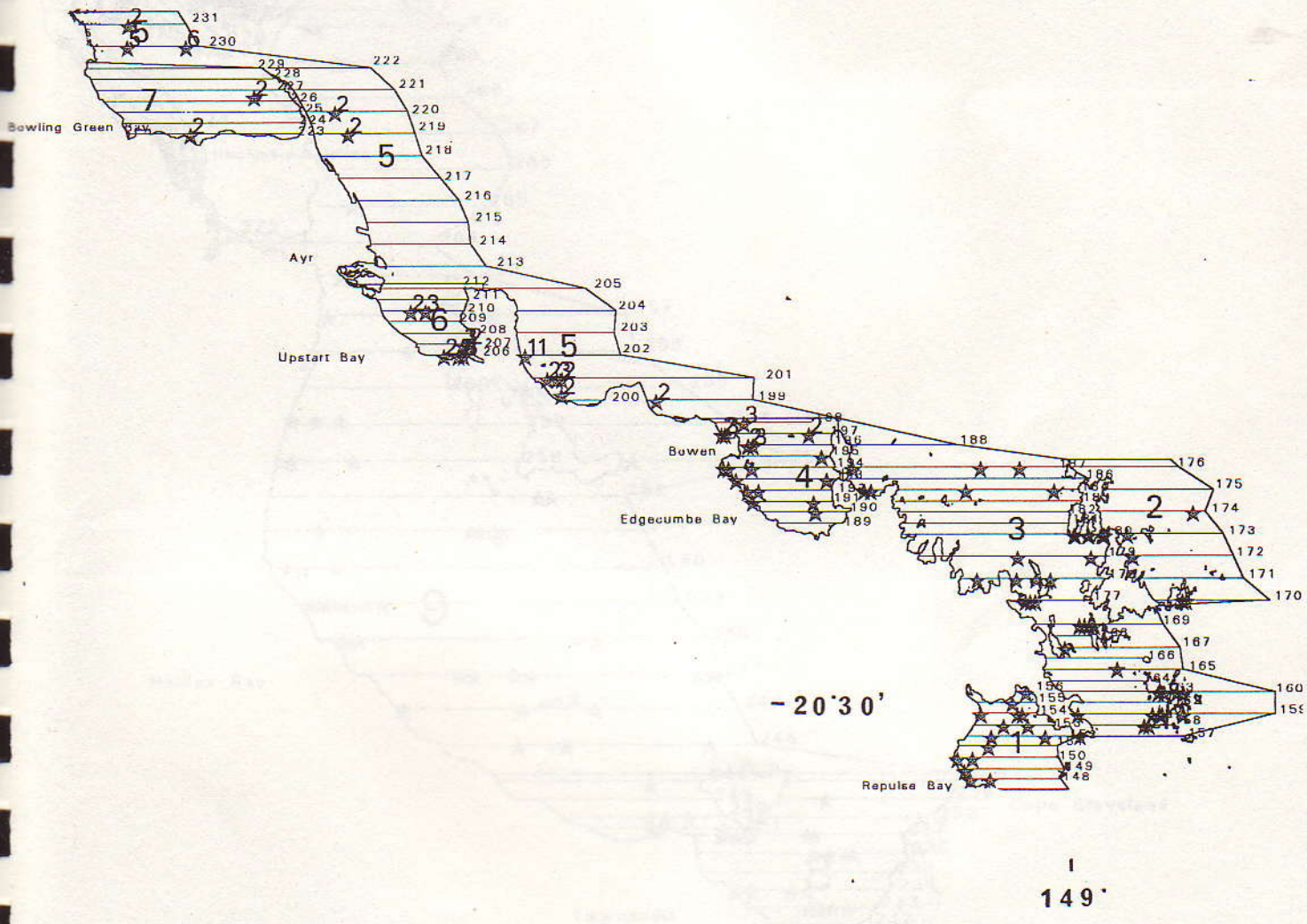
Appendix Figure 7: Survey area from Water Park Point to Rodds Bay (Mackay-Capricorn Section) showing the transect numbers and positions of turtle sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



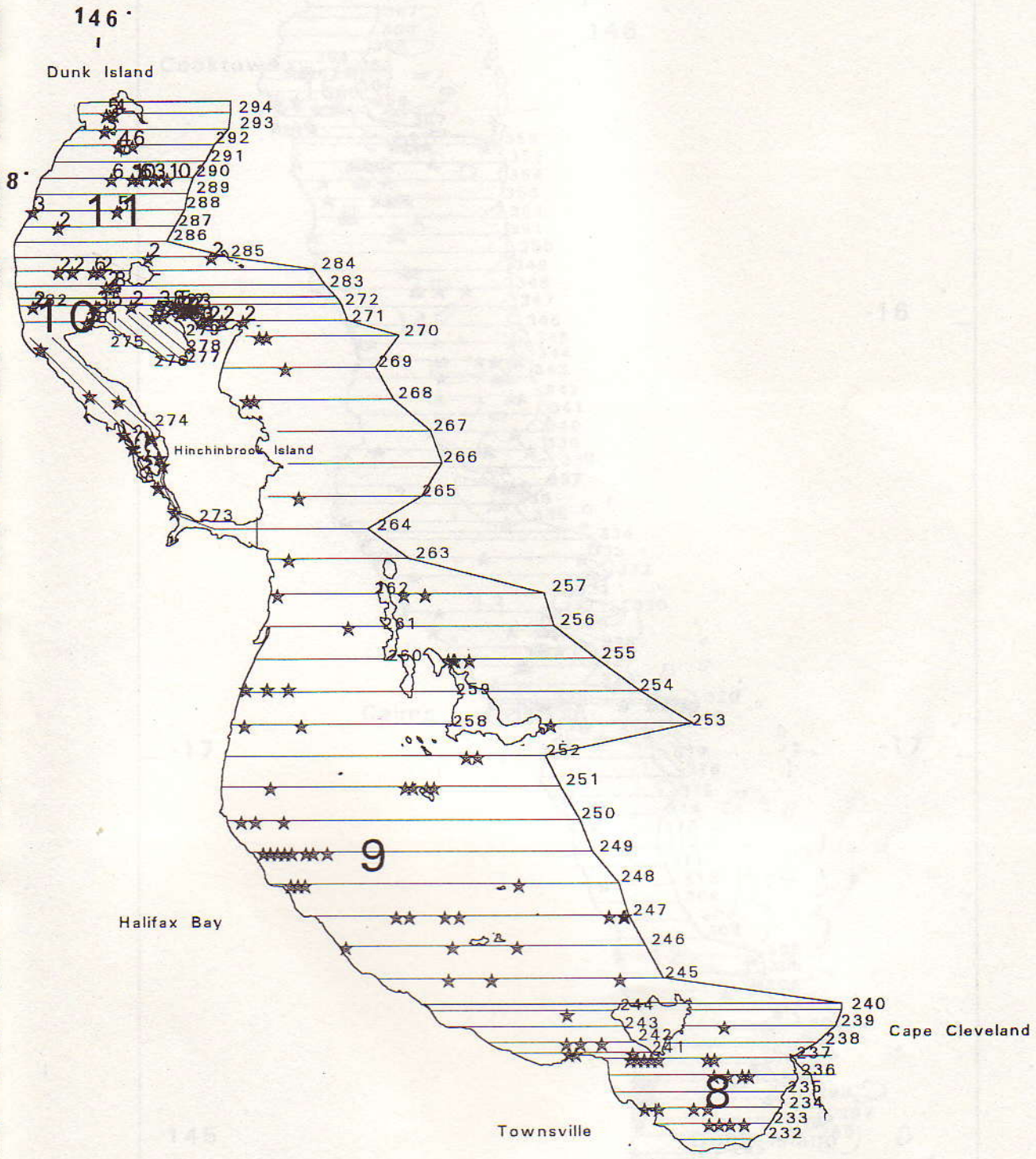
Appendix Figure 8: Survey area from Ince Bay to Water Park Point (Mackay-Capricorn Section) showing the transect numbers and positions of turtle sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



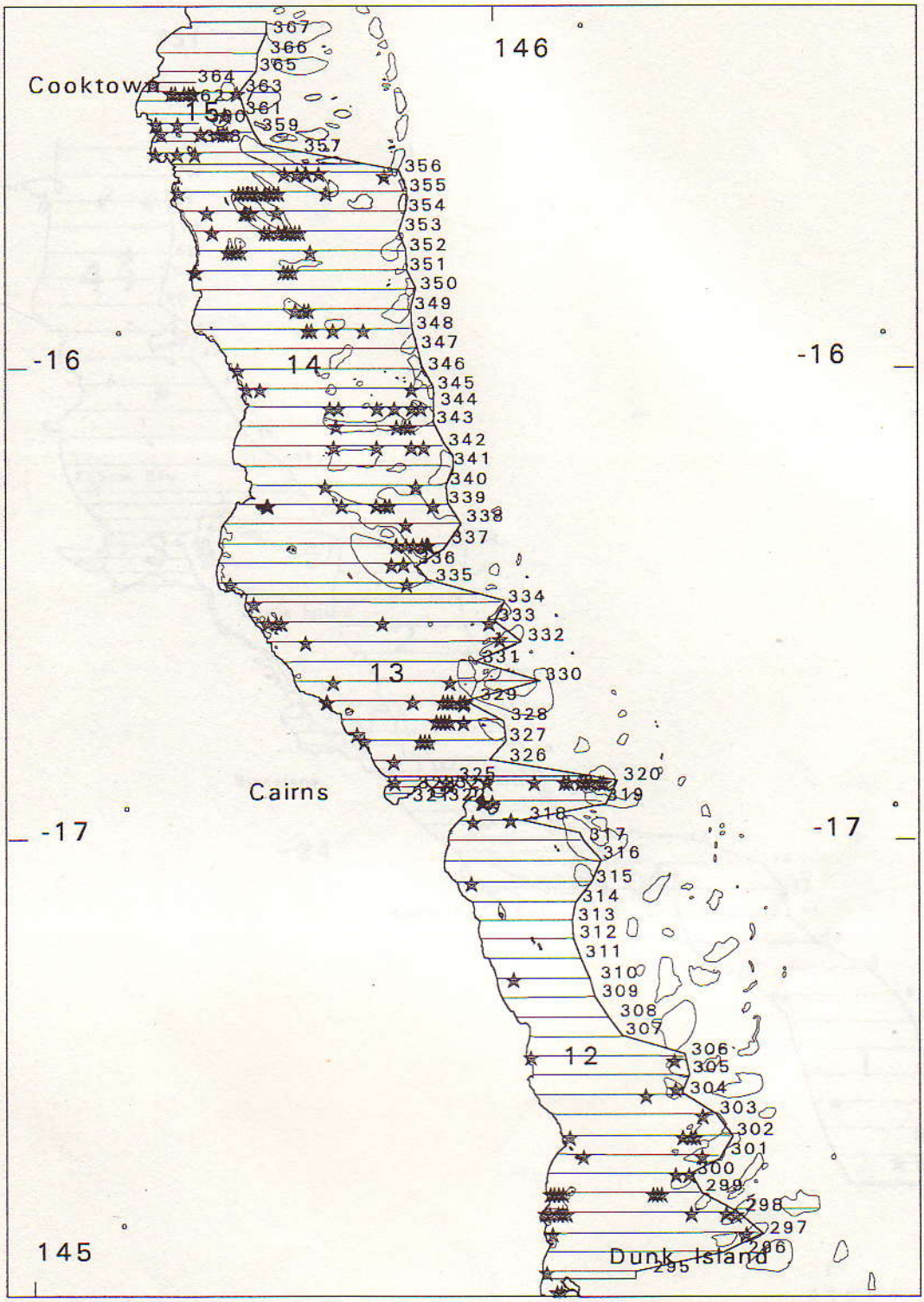
Appendix Figure 9: Survey area from Repulse Bay to Ince Bay (Mackay-Capricorn Section) showing the transect numbers and positions of turtle sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



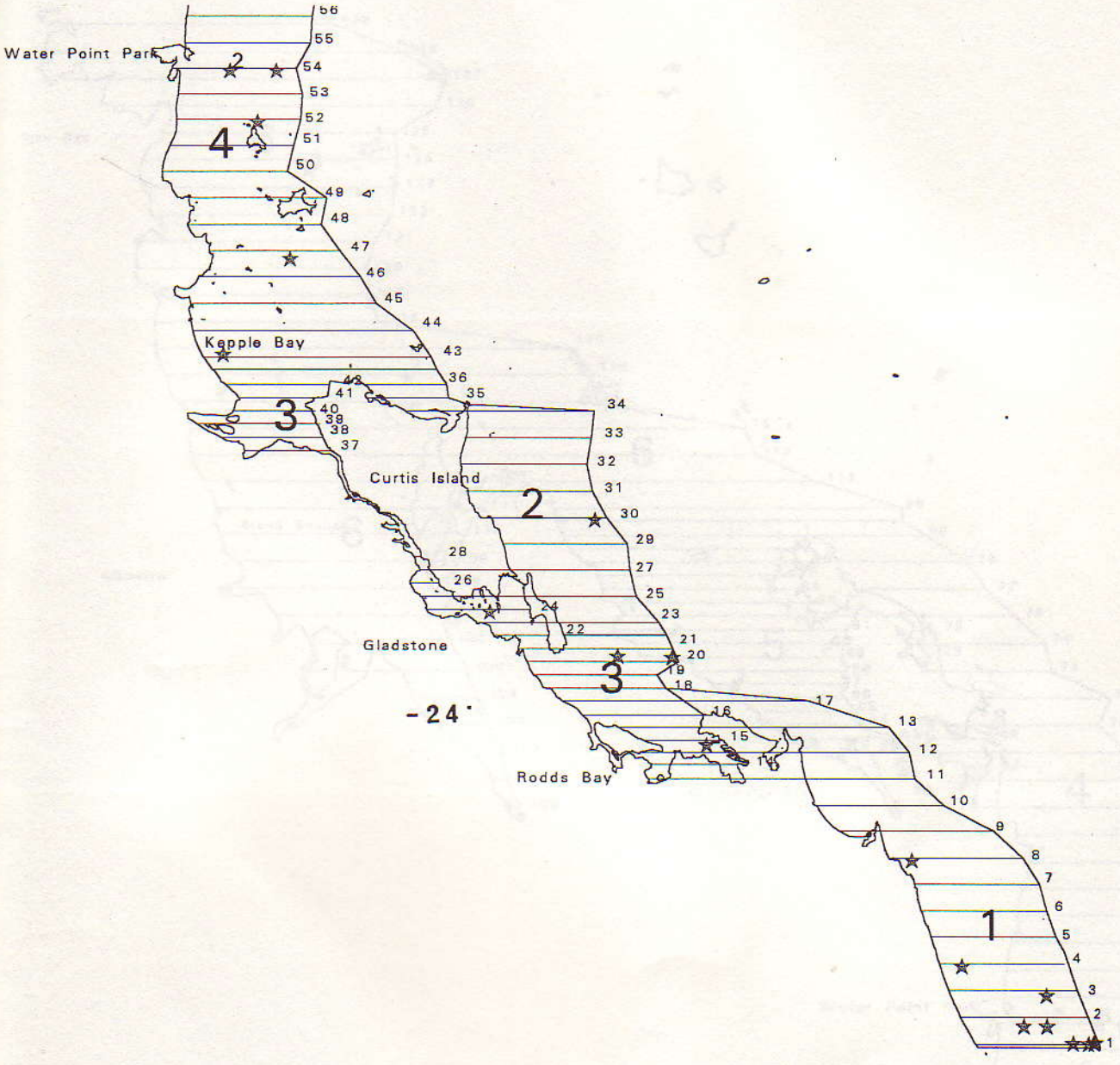
Appendix Figure 10: Survey area from Cape Cleveland to Repulse Bay (southern Central Section) showing the transect numbers and positions of turtle sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



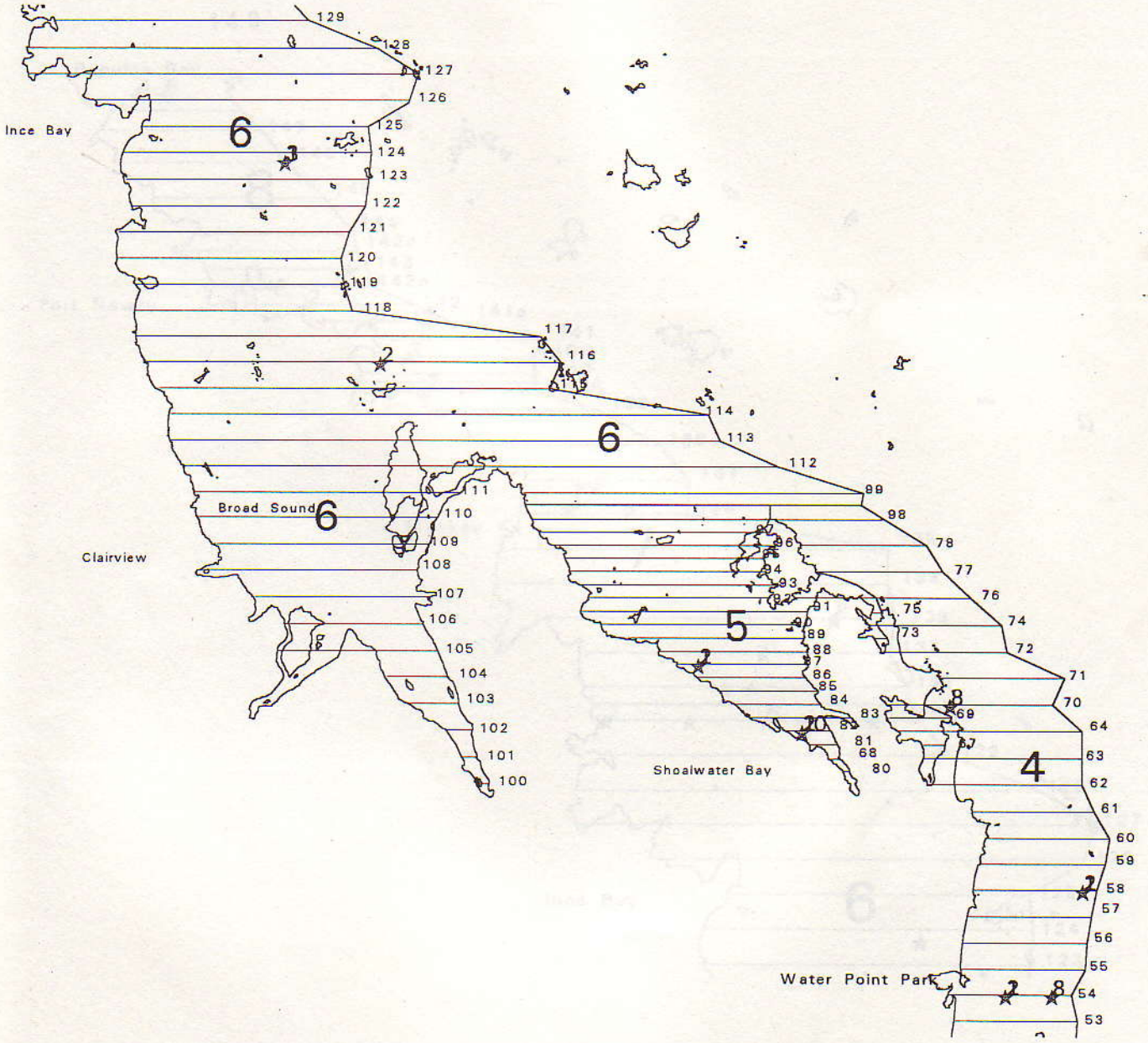
Appendix Figure 11: Survey area from Dunk Island to Cape Cleveland (northern Central Section) showing the transect numbers and positions of turtle sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



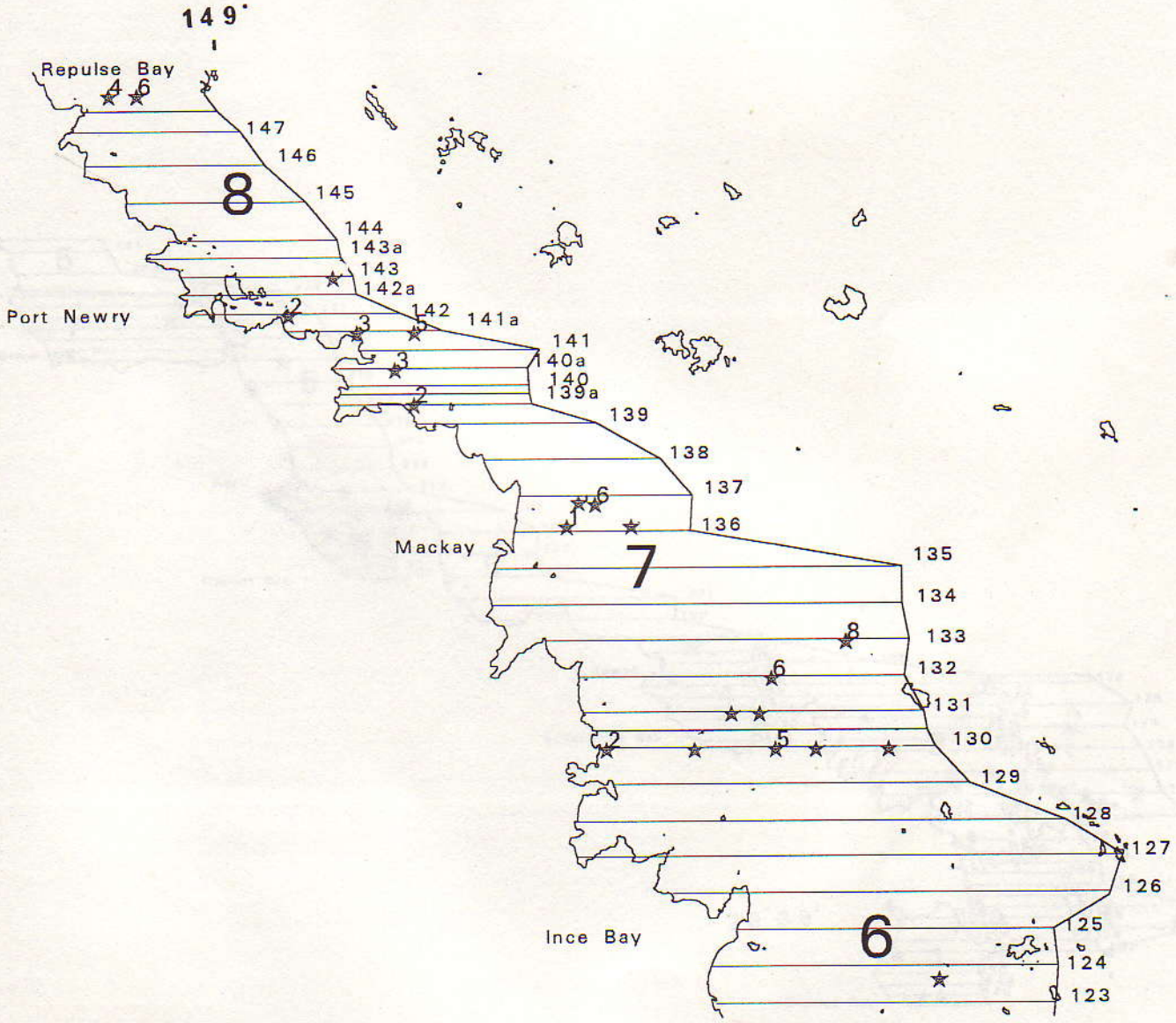
Appendix Figure 12: Survey area from Cape Bedford to Dunk Island Cairns Section) showing the transect numbers and positions of turtle sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



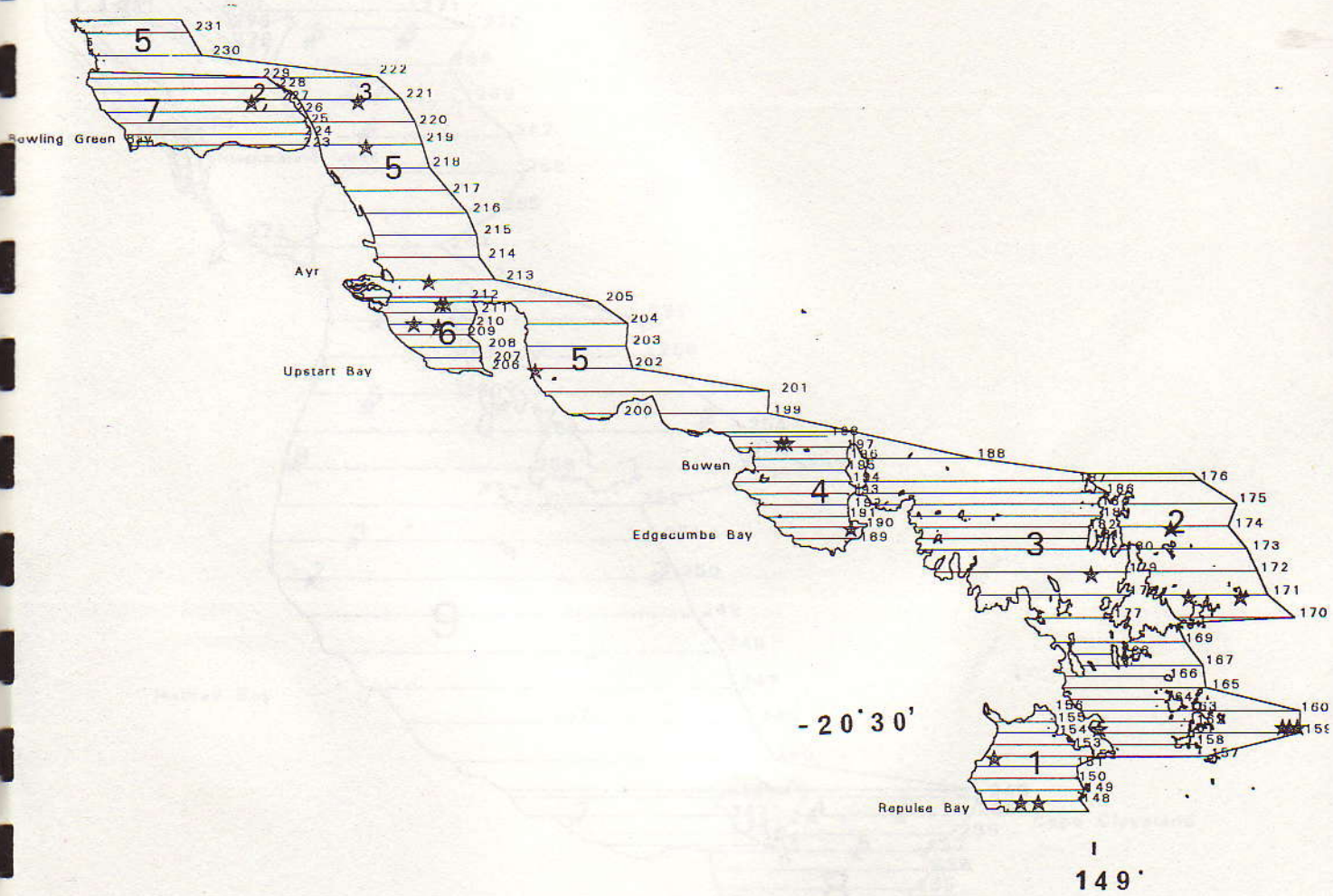
Appendix Figure 13: Survey area from Water Park Point to Rodds Bay (Mackay-Capricorn Section) showing the transect numbers and positions of dolphin sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



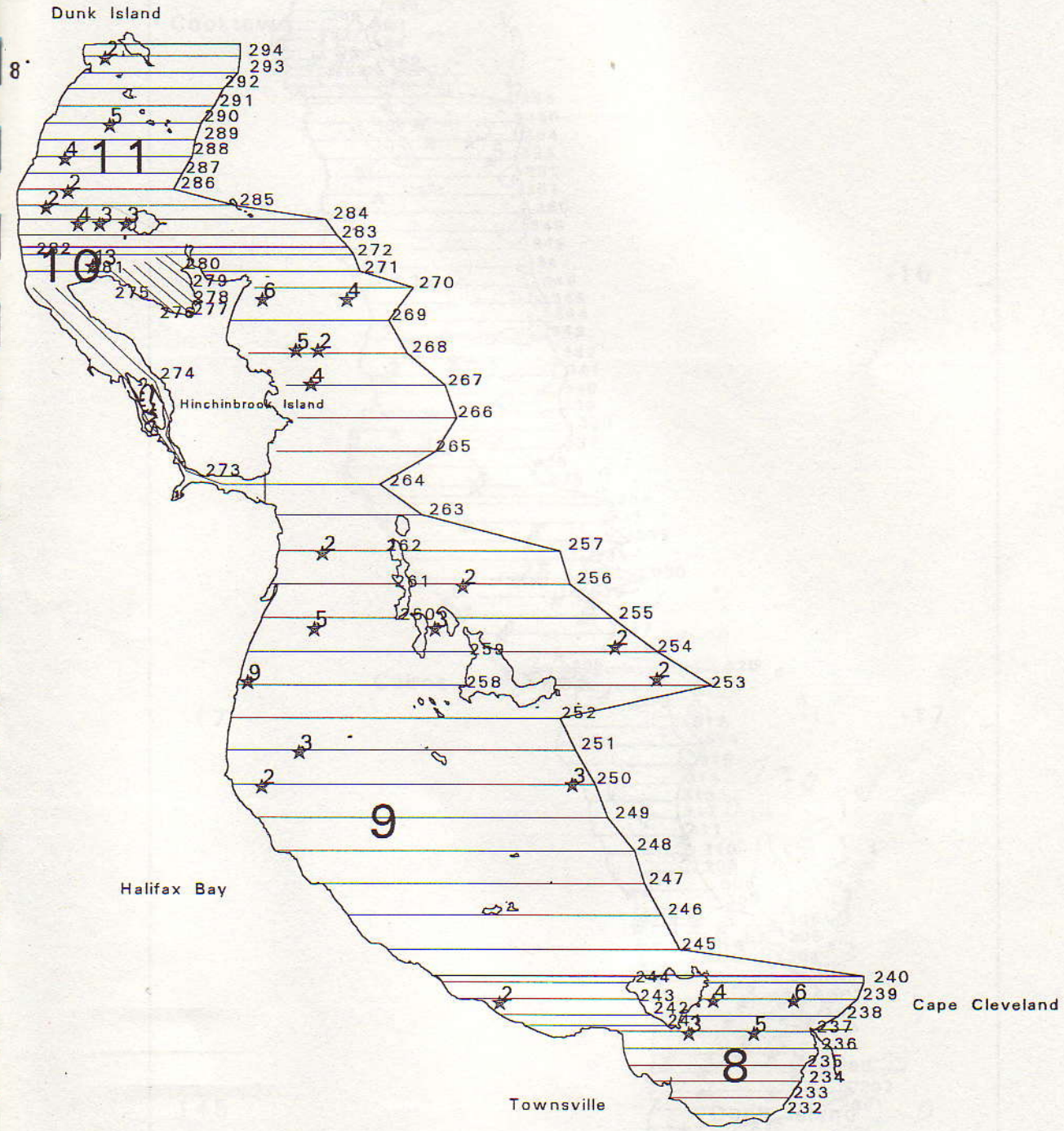
Appendix Figure 14: Survey area from Ince Bay to Water Park Point (Mackay-Capricorn Section) showing the transect numbers and positions of dolphin sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



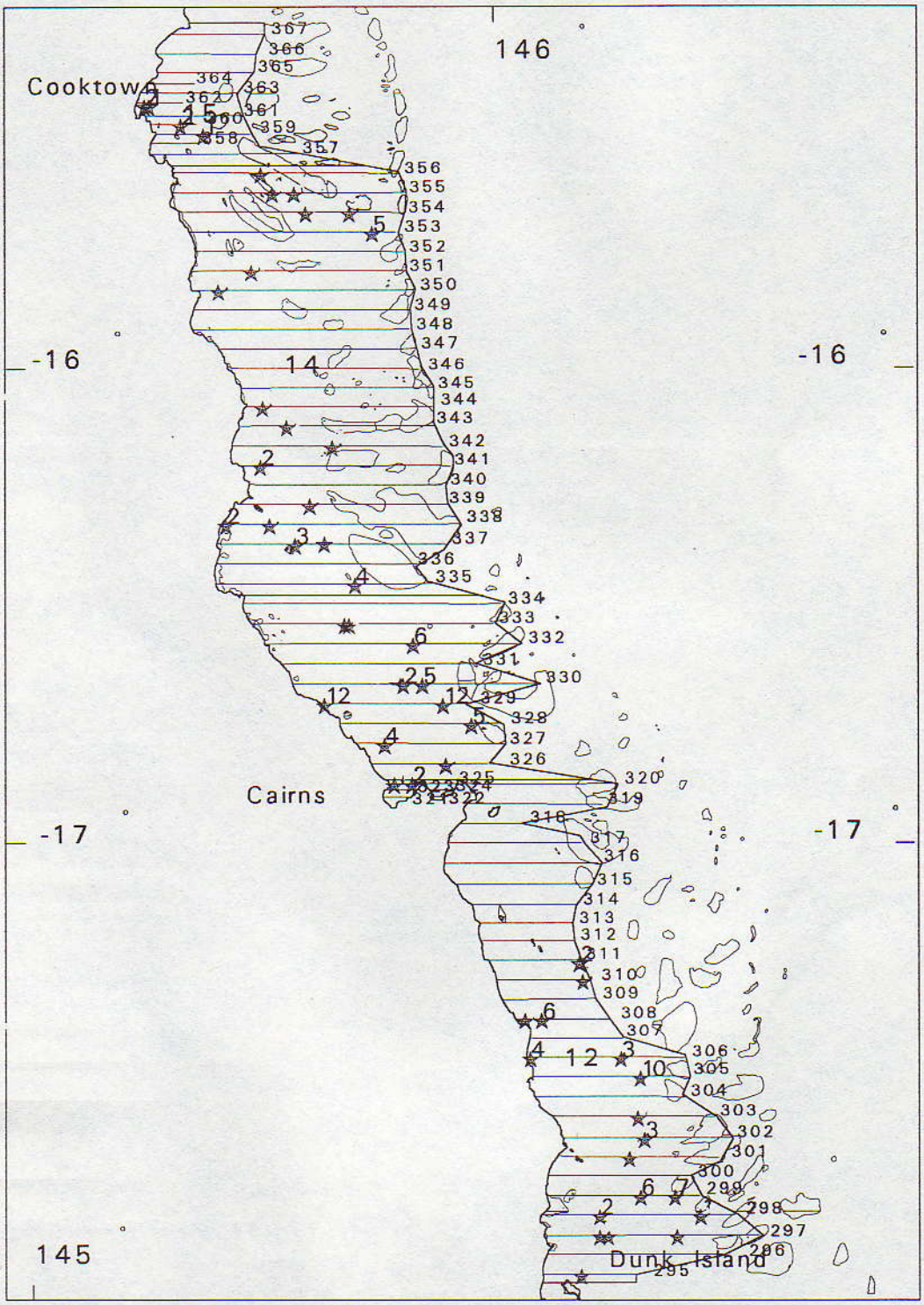
Appendix Figure 15: Survey area from Repulse Bay to Ince Bay (Mackay-Capricorn Section) showing the transect numbers and positions of dolphin sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



Appendix Figure 16: Survey area from Cape Cleveland to Repulse Bay (southern Central Section) showing the transect numbers and positions of dolphin sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



Appendix Figure 17: Survey area from Dunk Island to Cape Cleveland (northern Central Section) showing the transect numbers and positions of dolphin sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.



Appendix Figure 18: Survey area from Cape Bedford to Dunk Island Cairns Section) showing the transect numbers and positions of dolphin sightings in November-December 1992. The numbers associated with the sightings do not necessarily reflect the sizes of the actual groupings observed. Unnumbered stars represent a group of 1.