The 2011-14 Reef Catchments Beef Industry Survey Report

Queensland Government

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Acknowledgements

The Herd Management Report project is grateful to the Queensland Government, the primary supporting and funding body for this project. The Herd Management project team would also like to acknowledge:

- Mick Sullivan and Dave Smith, Senior Beef Extension officers from the Queensland Department of Agriculture and Fisheries
- Peter Smith, an external beef extension advisor
- Sue Carstens, a senior project co-ordinator
- Kevin McCosker, the Paddock to Reef program leader
- Producers who participated in and provided data for the report
- Various consultants for their contribution, assistance and co-operation.

Summary

The grazing management practice adoption (GMPA) survey included enterprises from 435 surveys, with 258 enterprises within the herd management section. Enterprises were surveyed across five catchments, the Burnett Mary, Burdekin, Fitzroy, Mackay Whitsundays, and the Wet Tropics. The number of enterprises, median property and herd sizes for each catchment are shown in Table 1.

Table 1: Number, median property size and herd size for 2011-14 survey enterprises

	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics	All Catchments
Number of enterprises	49	87	94	49	2	258
Median property area (ha)	2,294	22,300	7,100	1,733	120	3,436
Median herd size (head of cattle)	700	3,650	1,800	350	100	850

Markets and turnoff

The percentage of enterprises with breeding herds ranged from 85% in the Fitzroy to 90% in the Burnett Mary. Enterprises producing breeding cattle for slaughter were more common in the Burdekin (59%) and the Fitzroy (56%), while enterprises breeding and selling store cattle were more common in the Mackay Whitsundays (62%). Enterprises that grow/finish transferred/ purchased cattle ranged from 8% to 11% across catchments

Destination markets differed across production systems. Fifty-five percent of enterprises producing finished steers sold to the Jap Ox market. Fifty-six percent of enterprises sold store cattle to grass/crop finishers. Enterprises selling to the EU market ranged from 14% in the Burnett Mary to 75% in the Burdekin for steers/ bullocks and 25% in the Mackay Whitsunday to 83% in the Fitzroy for slaughter cows. Live export was used by 8% of enterprises across all catchments, except in the Burdekin catchment (20%). The majority of enterprises (62%) sold heifers to the domestic market. The majority of enterprises (81%) sold cows to the US market.

Meat Standards Australia (MSA) compliance averaged 36% across catchments, although this varied between catchments. Mean MSA compliance ranged from 8% in the Mackay Whitsundays to 57% in the Burnett Mary. The Fitzroy had a higher mean compliance rate (33%) than the Burdekin (29%).

Enterprises in the Burdekin catchment sold the highest number of males (3178) and females (2609) over five years, followed by the Fitzroy (males: 2516, females: 1460), Burnett Mary (males: 801, females: 665), Wet Tropics (males: 450, females: 325), and the Mackay Whitsundays (males: 306, males: 308).

Weaner management

Average weaning rates ranged from 50% in breeders not segregated by age in the Burdekin to 88% in the Burnett Mary in first calf heifers. Minimum weaning weight was highest in the Wet Tropics (250kg) in good seasons and in bad seasons (200kg). The Burdekin recorded the lowest minimum weaning weight average for both good (176kg) and bad (128kg) seasons.

Heifer management

The most common practice across catchments was to manage replacement females (heifers) separately. Thirty-two percent of enterprises managed heifers until their first joining and 24% of enterprises managed heifers separately until after weaning their first calf. Only 11% of enterprises managed heifers until after the weaning of their second calf. This is consistent across catchments. Not managing heifers separately had the largest range across catchments, with 5% of enterprises in the Burdekin using this strategy and 29% in the Mackay Whitsunday.

The most common joining practice, regardless of catchment or age of first joining, was to join 100% of the heifers of an age group. Half of enterprises across catchments joined heifers between 18 and 24 months, 32% of enterprises joined between 12 and 18 months and 18% joined heifers older than 24 months. There was some tendency to join heifers at different ages in the Burdekin and Fitzroy catchments.

In the Burnett Mary and Burdekin 28% and 52% of enterprises were more inclined to join heifers at 250-300kg while in the Fitzroy, 56% of enterprises joined heifers at >300kg. Overall, 7% of enterprises across catchments joined heifers between 200-250kg, 45% joined at 250-300kg and 48% joined at >300kg.

Breeder management

Controlled mating of breeders was the most common practice across all catchments, except the Mackay Whitsunday. Enterprises in the Burnett Mary (87%) were more likely to use controlled breeding, followed by the Fitzroy (68%) and Burdekin (53%). Overall, the percentage of enterprises which control mated breeders (62%) and 1st lactation heifers (62%) were similar, however, more enterprises control mated maiden heifer's (72%).

The percentage of enterprises using pregnancy testing was as follows: Burnett Mary (81%), Burdekin (86%), Fitzroy (83%), and Mackay Whitsunday (58%). The most common pregnancy-testing practice across all catchments was to test all cows and dry cows.

Bull management and selection

Bull breeding soundness examinations (BBSE) were used by the majority of enterprises across catchments, ranging from 72% of enterprises in the Burnett Mary to 43% in the Mackay Whitsundays and over 50% for the other catchments. The percentage of bulls to females ranged from 2.5% in the Wet Tropics to 3.4% in the Burdekin.

Brahman, Droughtmaster, and Santa Gertrudis bulls were the most commonly purchased *Bos indicus* bulls. For *Bos taurus* bull breeds, Angus bulls were the most commonly purchased and Belmont Red bulls were the most commonly purchased for composites and crossbreeds.

Estimated breeding values (EBVs) were used by around a half of enterprises across most catchments, except the Mackay Whitsundays where only 20% of enterprises used EBVs. Most users of EBVs had a moderate level of understanding. The top five EBV's across all catchments, in order of priority, were; 400 day weight, 600-day weight, birth weight, 200-day weight and scrotal size.

Health and nutrition (vaccination and supplementary feed)

Vaccination usage varied across classes of cattle and across catchments; the mostly commonly administered vaccines for each cattle class was as follows:

- Weaners: 5 in 1, 7 in 1 and botulism
- Replacement heifers and breeders: botulism, 7 in 1 and leptospirosis
- Bulls: Vibriosis and botulism

A large majority of enterprises fed cattle supplements across all catchments. Generally, dry season protein supplements were preferred to dry season energy and protein supplements for all cattle classes. This was consistent across catchments, except the Burnett Mary where enterprises preferred energy and protein supplements. During bad years, protein supplements were generally preferred across all catchments and cattle classes. The exception was weaners, where the preferred option was protein and energy supplements.

Across all catchments less than 15% of enterprises fed wet season phosphorous and fewer than 10% of enterprises fed wet season salt and sulphur. Supplement costs were similar in the Burdekin ($18/head) and Fitzroy ($17/head) and was highest in the Mackay Whitsunday ($42/head).

Stock Handling and record keeping

Across catchments, a large majority of enterprises (85%) did not use foetal aging. The Burdekin (16%) and Fitzroy (17%) had the highest usage rates of foetal aging, while Mackay Whitsunday (4%) had the lowest usage rate.

The majority of enterprises (65%) did not use individual animal performance data. Use of individual animal data was highest in the Fitzroy (46%) and lowest in the Mackay Whitsundays (4%). Of those using individual data, the most common method was with electronic identification (EID) ear tags and management tags (14%).

Weaners were the most commonly handled class of cattle and steers the least. On average, Burdekin enterprises handled 7,790 cattle annually at an average cost of $64,213. The Fitzroy handled 7,425 cattle annually at a cost of $30,221. Robust data was not able to be collected for other catchments.

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1.0 Background

Rangeland beef production is one the major land uses in the Great Barrier Reef (GBR) region (Gordon and Nelson, 2007) accounting for 78% of the total land area (Australian Bureau of Statistics, 2014). (Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)(Australian Bureau of Statistics, 2014)The Burdekin and Fitzroy Natural Resource Management (NRM) regions are the largest beef producing catchments accounting for 83% and 84% of livestock grazing in the GBR region for 2009 - 2013 respectively (Australian Bureau of Statistics, 2014).

Current data detailing the management practices and productivity of the Queensland grazing industry, specifically in those catchments adjacent to the GBR, is limited and often inadequate for detailed analysis. The difficulty in obtaining this data can be attributed to the size of Queensland, the number of grazing enterprises as well as resource availability in terms of on ground extension staff. Understanding the current management practices used by graziers is critical for planning and implementing research, development and extension policies and programs (RD&E). However the diversity and complexity of practices currently used, makes it challenging to accurately document industry level practices as for many aspects of land and livestock management the ‘best’ practice is not easily identifiable (Sullivan, 2015). Most previous studies of commercial beef herd performance have been limited to small sample sizes and restricted regions.

Previously, there have been only two instances where data detailing the management practices and productivity of grazing enterprises has been collected in Queensland. O'Rourke et al. (1992) conducted a survey that targeted beef enterprises in Northern Australia that carried greater than 300 head of cattle. This survey was undertaken prior to the rapid expansion of the live cattle trade when industry and government organizations were concerned about the ability of the Australian beef industry to meet current and future demands (Bortolussi et al., 2005a). The survey conducted by O'Rourke et al. (1992) collected data to understand the productivity and management practices of the northern beef herd as well as the production capacity of north Australian pasture communities (Bortolussi et al., 2005a).

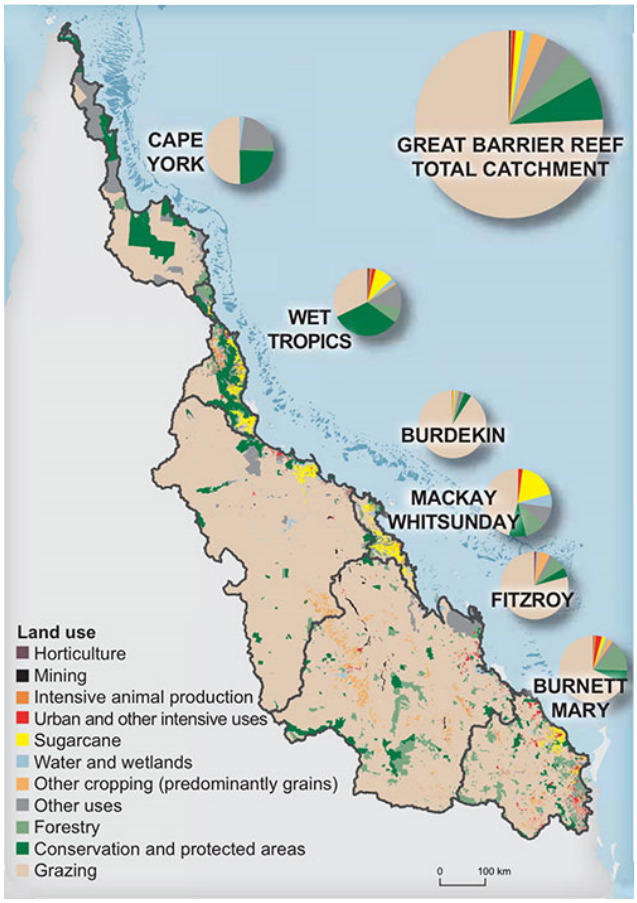
Following this, in 1996/97, Bortolussi et al. (2005a) conducted a survey of the northern beef industry to examine to performance of beef herds over the period of 1991/92 – 1995/96 financial years. Bortolussi et al. (2005a) targeted grazing enterprises based on their bio-geographic characteristics, specifically the northern Australian pasture communities, using shire or government divisions to define survey boundaries. This survey collected data similar to that of O'Rourke et al. (1992) and enabled the development of a more detailed picture of the beef industry at the time.

More recently in 2011, as part of Reef Plan, a longitudinal survey was developed to investigate and capture the current adoption levels of grazing land management practices of graziers in the catchments adjacent to the GBR. This survey collected data from 435 graziers across the GBR region from 2011-2014. As part of this survey a herd management component was included to collect data relating to the productivity of grazing enterprises. This survey was completed by 258 graziers (59% of total graziers surveyed) across all five NRM regions (Figure 2). This report summarizes the baseline data resulting from the herd management surveys conducted from 2011 to 2014 in the NRM regions adjacent to the GBR.

1.1 Survey Area

The study area for the surveys covers an area of 38,508,500 hectares, and encompasses five NRM regions adjacent to the GBR (Figure 1). The climatic conditions and land systems vary significantly across each region. More information regarding these variations can be found in the Paddock to Reef Grazing Baseline Technical Report for 2015(Barbi and McCosker, 2015).

Figure 1 Natural Resource Management regions of the Great Barrier Reef catchment (QLD Department of Premiers and Cabinet, 2009)



2.0 Methods

2.1 Reporting area

The Grazing Management Practice Adoption Survey (GMPA) project, 2011-2014, encompassed five natural resource management (NRM) regions adjacent to the GBR covering an estimated area of 424,000 km^2 (Figure 1) (Department of the Premier and Cabinet, 2015). For this technical report the data analysed are drawn from 435 surveys completed by individual grazing businesses within these five NRM regions.

2.2 Project processes

The project was delivered in two distinct stages. Approximately 60% of the target was achieved with a total of 435 surveys completed across all catchments. It should be noted that there were a number of surveys (64) that were incomplete or not able to be used in analysis due to inconsistency of data/survey question interpretation. Of the 64 surveys, 10 were collected in the Cape York catchment, and due to a lack of samples these surveys were excluded from the analysis.

Stage One (2011/12-2012/13)

Stage one involved a rigorous process of randomisation and stratification to arrive at a set number of properties to be surveyed, with a target of 400 properties per annum[1] for two years across the whole Great Barrier Reef catchment. Meeting this target was hampered by a number of factors which precluded some property owners being involved in the survey process: agency extension resource availability; changes in land use from that defined spatially; and personal, seasonal and climatic considerations. A total of 470 surveys were completed during Stage one however only 406 were used for analysis due to a number of issues previously mentioned.

Stage Two (2013/14)

Stage two involved a less rigorous randomisation process and used a more opportunistic and subjective approach to survey delivery. Surveys were undertaken by contracted extension staff external to the Department in an effort to bolster the survey numbers in catchments and sub-catchments where survey numbers were identified as particularly deficient. A total of 29 surveys were completed during Stage two of the project bringing the total number of completed surveys for analysis to 435.

2.3 Project delivery

Prior to the start of the full scale project in November of 2011 an eight week pilot project was undertaken. The aim of the pilot project was to test the survey content, ease of delivery based on format and applicability of randomised selection of properties based on catchment, sub catchment and stratification of property size.

The project team consisted of Animal Science Extension Staff from each catchment area; the Paddock to Reef Program Leader and a designated Survey Project Coordinator who oversaw the delivery of the project from July 2011 to October 2014. This group met bi-annually throughout the project at different locations across the State, as well as holding quarterly teleconferences to:

- review the suitability of the framework questionnaire and random selection process;
- review the suitability of data collection and storage methods,
- identify issues and opportunities to enhance project output; and
- develop a final implementation schedule for properties to be surveyed for the 11/12 and 12/13 financial years.

The team was proactively involved in the randomisation process of property selection; weightings applied to the Management Practice framework and the design/development of both surveys. Two Stakeholder Forums were held to show case the outcome of the project and to demonstrate the applicability of data analysis for multiple uses beyond the scope of the actual project. The process was a full participatory and dynamic approach which responded to feedback and opportunities of refinement and enhancement as the project progressed. In all, the surveys underwent nine versioning episodes.

[1] An initial target of 400 properties per year for two years across the whole GBR was recommended by a biometrician from the Department of Agriculture and Fisheries (DAF, previously DEEDI) to enable a 95% Confidence Interval of +/- 4.5%, conditional upon the sampling being random and consistent across space and time.

2.4 Property selection

2.4.1 Random sampling of properties to be surveyed

Each catchment was broken into target sub catchments and using the percentage of land area per sub catchment an overall percentage of total sample size was determined. This figure was used to determine how many properties would be allocated per sub catchment (Table 2). Sampling was stratified by property size to capture any effect of scale on management - Small, Medium or Large. Bandwidths for property sizes were determined on a regional basis to address the fact that some regions are more extensive than others. The main criteria determining the sample number within each bandwidth was the area occupied by properties of that size. A subjective review of sub catchment properties was undertaken by the project team prior to randomisation being applied to remove properties that were below 20ha in size and any known anomalies (i.e. State Forestry; Piggeries; Cropping Land).

Table 2: Property size bandwidths for sampling

Catchment	Sub catchment	Small (ha)	Medium (ha)	Large (ha)	Annual sample size per catchment
Cape York	-	No Bandwidth Applied			10
Wet Tropics	-	No Bandwidth Applied			70
Burdekin	Bowen	2,000-6,999	7,000-14,999	15,000+	100
	Burdekin (Upper & Lower)	2,000-9,999	10,000-29,999	30,000+	
	Suttor	2,000-9,999	10,000-29,999	30,000+	
Mackay Whitsunday	Pioneer, Plane Creek, Proserpine, O'Connell	120-9,99	1,000-2,499	2,500+	50
Fitzroy	Isaac, Mackenzie	1,000-3,999	4,000-7,999	8,000+	120
	Fitzroy	500-999	1,000-3,999	4,000+	
	Dawson	1,000-3,999	4,000-7,999	8,000+	
	Comet, Nogoa	1,000-3,999	4,000-7,999	8,000+	
Burnett Mary	Baffle, Barambah, Burnett, Kolan, Boyne	20-499	500-999	1,000+	50

Each sub catchment data table was exported to Excel and subjected to:

a) rand() function;
b) rand() Value copied and pasted as a Value in the next column;
c) ascending order applied against the pasted value;
d) sort applied to the area of the property to assign stratification where applicable (S,M,L); and
e) properties coded according to catchment; sub catchment and number. Each sub catchment had a pool of first call surveys; and a pool of opt out surveys to be used as a reserve should all first call survey codes be utilised.

These lists served the purpose of prescribed properties identified for surveying during Stage one of the project and subsequent reselection of additional properties were drawn from the list of properties as assigned randomly. Stage two continued to draw on the listings produced in Stage one, however they allowed for more opportunistic identification of additional landholders outside of this process in order to increase the number of surveys taken to inform the industry benchmark.

2.4.2 Spatial Mapping

All properties identified during Stage one of the project and the majority of properties utilising the same list during Stage two had spatial data assigned to the Property/Survey ID (DCDB or PIC) using the identified data sets below. Geographical information systems (GIS) software was used to map the spatial spread of surveys conducted. In some instances, the opportunistic surveys that were undertaken did not have a spatial identifier allocated and unfortunately cannot be mapped.

1. Datasets: AgForce Property DCDB; DERM Catchment and Sub Catchment shape files

2.5 Survey development

The survey exists in two formats:

1) Management Practice Adoption and Extension Survey (based on Paddock to Reef Grazing Framework)

- Framework describes practices likely to impact upon land condition, soil erosion, and water quality.
- It is congruent with practices as described in the Grazing BMP Program and the Reef Protection Package.
- Has a rangelands' focus and a version applicable for intensive coastal grazing systems.

2) Herd Management Survey (Opportunistic addendum to (1) which was designed by Animal Science Extension Officers)

- Quantitative data on livestock production and management practices.
- Data to be used to inform future RD&E investment, both in terms of resource condition and productivity growth.

The Management Practice Adoption and Extension Survey consisted of two main sections, Wet Coastal and Rangeland grazing component, to address the different climatic areas within the NRM survey regions. Survey questions for both were developed based on their alignment with the Wet Coastal and Rangeland grazing Water Quality (WQ) Risk framework developed by McCosker (2014). Additionally both the Wet Coastal and Rangeland grazing surveys included an extension and demographics component as well as an optional herd management component.

The Rangeland grazing survey consisted of 25 questions categorized into five sections that provided a description of:

- stocking rate practices;
- grazing land management strategies;
- practices used to regenerate degraded areas of land;
- weed and pest management strategies; and
- how graziers used agricultural chemicals.

It should be noted that for the Rangeland grazing survey component only 14 out of the 25 questions included directly relate to the WQ Risk framework. Nine extra questions were included for practical reasons, therefore were not included in the development of benchmarks and baselines. The Wet Coastal grazing survey consisted of 18 questions categorized into six sections that provided a description of:

- stocking rate practices;
- grazing land management strategies;
- management strategies used for riparian zones and wetlands;
- management of degraded areas of land;
- weed and pest management strategies; and
- the use of fertilizers and legumes in pastures

Both the Rangeland and Wet Coastal grazing surveys can be found in the Appendices section of the Paddock to Reef Grazing Baseline Technical Report.

2.6 Herd Management Survey

2.6.1 Reporting area

The data analysed for this report is drawn from surveys completed by 258 enterprises distributed across five NRM regions over a four year period, from 2011-2014 (Table 3). The survey covered approximately 15% (4,352,515 ha) of the total grazing land area in the GBR region.

Table 3: Herd management survey demographics

Region	Number of producers that responded to Herd Management survey	Percentage of producers surveyed	Total land area managed by producers surveyed (ha)	Total area used for grazing by producers surveyed (ha)[2]	Percentage of total area used for grazing by producers surveyed
Wet Tropics	2	1%	8,300	735,000	1%
Burdekin	87	34%	2,952,771	12,656,900	23%
Mackay Whitsundays	25	10%	87,371	379,200	23%
Fitzroy	94	36%	960,794	12,425,000	8%
Burnett Mary	49	19%	343,279	3,812,700	9%
Great Barrier Reef	**258**	**-**	**4,352,515**	**30,008,800**	**15%**

[2] AUSTRALIAN BUREAU OF STATISTICS 2014. Land Account: Great Barrier Reef Region, Experimental Estimates. *In:* COMMONWEALTH OF AUSTRALIA (ed.). Australia.

2.6.2 Survey development

The Herd Management survey consisted of 26 questions relating to markets and turnoff, weaner, heifer and breeder management, bull selection and management, health and nutrition, as well as record keeping (7.2 Herd Management Survey). A working group including AgForce, several Queensland Government departments (Department of Agriculture and Fisheries, Department of Natural Resources and Mines, Department of Environment and Heritage Protection) and consultants developed the survey questions. The survey questions were based on previous surveys undertaken in Queensland (Bortolussi et al., 2005a, O'Rourke et al., 1992), current key cattle management recommendations and the surveys conducted by the Northern Territory Department of Primary Industries.

As the survey was conducted over a four year period some questions in the survey require year specific data to be collected e.g. weaning rates. The years on the survey form were adjusted to be appropriate for the year the survey was conducted to allow collection of year specific data.

2.6.3 Survey Delivery

The emphasis on delivery for this project was one-on-one, individual surveys conducted on property by Department of Agriculture and Fisheries (DAF) extension officers and other departmental staff, as well as external contractors (7.3 List of survey staff). At times, it was necessary to conduct the survey over the phone based on seasonal and climatic circumstances. The interviewing officer would identify the landholder/grazing business to be surveyed, make contact, undertake the survey if permission was granted and then enter the survey results into the online database, using the allocated Random Selection Property ID as the identifier.

2.6.4 Data collation and analysis

Data collected from the surveys was entered into an online database system managed by Coutts J&R. Survey data was exported once finalized for cleaning and analysis.

Data summary tables were constructed using the statistical package GenStat. The Excel data file was able to be imported directly into GenStat. By using coding within GenStat, a record is kept of exactly how the summary tables are constructed. It also allows for more ease when constructing tables for the various catchments. Some percentages were also calculated using Excel.

The total number of enterprises surveyed across each catchment is shown in Table 4 below. However, often for the herd management section, responses were not obtained from all properties. Only two properties surveyed from the Wet Tropics had responses for the Herd Management section of the survey. Although these results from these two properties are quoted in the summary tables, a sample of two cannot be considered representative of the Wet Tropics region. Percentages calculated are either of the total number of enterprises for that particular question for each of the catchments or of the total number of properties that were surveyed.

Table 4: Total number of enterprises surveyed in each catchment

Catchment	Total number of enterprises surveyed
Burnett Mary	85
Burdekin	98
Fitzroy	98
Mackay Whitsunday	28
Wet Tropics	125

Commonly the average value, percentage value and number of enterprises are presented. Medians are presented in some cases where the mean and median differ considerably.

Data summaries are presented as tables, bar graphs or schematic box and whisker plots. The box and whisker plots show the distribution of the data. The box spans the interquartile range (25%-75%). The smallest 25% of data values are represented below the box, the middle 50% of the data lie within the box and the largest 25% of data values are represented above the box. The horizontal line within the box indicates the median. The whiskers extend beyond the box as far as the maximum and minimum data values. For the plots presented in this report a schematic style is used to allow a better appreciation of the extreme values. The whiskers only extend to a distance on 1.5 times the interquartile range (or to the maximum or minimum if they are a smaller distance) then the remaining data values are indicated by a green 'x'. The red 'x' indicates values that are beyond a distance of 3 times the interquartile range.

2.6.5 Limitations and explanatory notes

This section provides some general limitations and explanatory notes to results obtained from the survey. When interpreting and using the results the following should be noted:

- Weights (live weights, weaning weights, and sale weights), ages, numbers and costs provided by producers were most likely estimated. This is true for all questions involving these factors.
- Some estimates (such as bull joining percentages) may reflect management policy, rather than a quantification of what exactly has occurred. Therefore it is likely some of the numbers reported will differ slightly from the actual numbers. These differences will be due to seasonal impacts and changes in management and marketing in response to market and seasonal conditions.
- The data has been quality checked twice, with every effort made to ensure consistent data integrity throughout the report.
- Data and results for the Wet Tropics are included in the report, but should not be considered a representative number for the broader catchment.

3.0 Results

This section provides aggregated information at a catchment level from survey responses. The data is presented under the major headings, Markets and turnoff, Weaner management, Heifer management, Breeder management, Bull selection and Health and nutrition. These summaries include brief descriptive statistics and key findings.

All aggregated data is also included in tables in several subsections. **Under each subsection, instructions are given for assisting with interpretation of results, where required and relevant.**

3.1 Markets and turnoff

3.1.1 Summary

The percentage of enterprises with breeding herds ranged from 85% in the Fitzroy to 90% in the Burnett Mary. Enterprises producing breeding cattle for slaughter were more common in the Burdekin (59%) and the Fitzroy (56%), while enterprises breeding and selling store cattle were more common in the Mackay Whitsundays (62%). Enterprises that grow/finish transferred/ purchased cattle ranged from 8% to 11% across catchments

Destination markets differed across production systems. Fifty-five percent of enterprises producing finished steers sold to the Jap Ox market. Fifty-six percent of enterprises sold store cattle to grass/crop finishers. Enterprises selling to the EU market ranged from 14% in the Burnett Mary to 75% in the Burdekin for steers/ bullocks and 25% in the Mackay Whitsunday to 83% in the Fitzroy for slaughter cows. Live export was used by 8% of enterprises across all catchments, except in the Burdekin catchment (20%). The majority of enterprises (62%) sold heifers to the domestic market. The majority of enterprises (81%) sold cows to the US market.

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Enterprises in the Burdekin catchment sold the highest number of males (3178) and females (2609) over five years, followed by the Fitzroy (males: 2516, females: 1460), Burnett Mary (males: 801, females: 665), Wet Tropics (males: 450, females: 325), and the Mackay Whitsundays (males: 306, males: 308).

3.1.2 Cattle enterprise

Question: Which best describes your cattle enterprise?

Enterprises were asked to indicate what type of cattle enterprise they had (Table 5). There were four enterprises indicating “other”. The four enterprises were:

1. All of the above except breeding and selling store cattle
2. Breed and finish
3. Breeding with progeny going to other family properties
4. A combination of two and three.

Table 5: Which best describes your cattle enterprise? (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Breed and finish mainly slaughter cattle	47 (23)	59 (50)	56 (53)	25 (6)	100 (2)
Breeding and selling store cattle	43 (21)	29 (25)	29 (27)	62 (15)	0
Growing/finishing transferred/purchased store cattle	10 (5)	8 (7)	11 (10)	8 (2)	0
Other	0	4 (3)	1 (1)	0	0
Stud breeding/Seedstock	0	0	3 (3)	4 (1)	0
Number of enterprises	**49**	**85**	**94**	**24**	**2**

3.1.3 Percentage of turnoff to markets

Question: What % of turnoff went to the following markets?

Enterprises were asked to indicate what percentage of their turnoff went to specific markets (Table 6 to Table 11). Responses were organised into two major markets categories, store cattle and slaughter cattle. They were further categorised into relevant sub-categories to provide more detail on particular markets. For example, store steers can be sold to grass/crop finishers, feedlots or live export.

Interpreting the tables is as per the following example. In Table 6, for the Burnett Mary catchment, a total of 23 enterprises sold steers to grass/crop finishers. Of these 23 enterprises who sold store steers to grass/crop finishers, 43%, or 10 enterprises sold 100% of their steers to grass/crop finishers. This interpretation is applicable for all store and slaughter tables below.

The numbers in parenthesis for 0-99% of turnoff column and the 100% of turnoff column equal the number of responses in the last column. These may not equal the total number of enterprises surveyed within each catchment as some may have chosen not to answer the question. Please note, enterprises may have answered up to two separate categories for each class of cattle and may be included in the last column multiple times if they send to different markets.

For example, a respondent in the Burdekin catchment may have responded that 0-99% of their store steers were marketed into each of the grass/crop finishers, feedlot and live export markets. The number in parenthesis therefore reflects number of responses or observations, not number of enterprises (individual grazing enterprises). It should also be noted that there were no observations recorded for the Wet Tropics. Enterprises indicating “Other” were not qualified.

3.1.3.1 Store cattle

Table 6: Percentage of enterprises selling to store steer markets (Number of enterprises in parenthesis)

Catchment	Market	0-99% of turnoff	100% of turnoff	Number of responses
Burnett Mary	Grass/crop finishers	57 (13)	43 (10)	**23**
	Feedlots	93 (13)	7 (1)	**14**
	Live export	0	0	**0**
	Other	33 (1)	67 (2)	**3**
Burdekin	Grass/crop finishers	62 (21)	38 (13)	**34**
	Feedlots	92 (12)	8 (1)	**13**
	Live export	85 (11)	15 (2)	**13**
	Other	75 (3)	25 (1)	**4**
Fitzroy	Grass/crop finishers	39 (9)	61 (14)	**23**
	Feedlots	65 (15)	35 (8)	**23**
	Live export	0	0	**0**
	Other	50 (1)	50 (1)	**2**
Mackay Whitsunday	Grass/crop finishers	71 (10)	29 (4)	**14**
	Feedlots	0	0	**0**
	Live export	100 (1)	0	**1**
	Other	100 (1)	0	**1**

Table 7: Percentage of enterprises selling to store heifer markets (Number of enterprises in parenthesis)

Catchment	Market	0-99% of turnoff	100% of turnoff	Number of enterprises
Burnett Mary	Grass/crop finishers	76 (13)	24 (4)	**17**
	Feedlots	79 (11)	21 (3)	**14**
	Live export	0	0	**0**
	Other	50 (2)	50 (2)	**4**
Burdekin	Grass/crop finishers	66 (19)	34 (10)	**29**
	Feedlots	58 (7)	42 (5)	**12**
	Live export	93 (14)	7 (1)	**15**
	Other	75 (6)	25 (2)	**8**
Fitzroy	Grass/crop finishers	61 (14)	39 (9)	**23**
	Feedlots	74 (20)	26 (7)	**27**
	Live export	0	0	**0**
	Other	100 (3)	0	**3**
Mackay Whitsunday	Grass/crop finishers	54 (7)	46 (6)	**13**
	Feedlots	0	0	**0**
	Live export	0	0	**0**
	Other	100 (1)	0	**1**

Table 8: Percentage of enterprises selling to store cow markets (Number of enterprises in parenthesis)

Catchment	Market	0-99% of turnoff	100% of turnoff	Number of enterprises
Burnett Mary	Grass/crop finishers	100 (1)	0	**1**
	Feedlots	0	0	**0**
	Other	0	100 (1)	**1**
Burdekin	Grass/crop finishers	40 (2)	60 (3)	**5**
	Feedlots	0	0	**0**
	Other	86 (6)	14 (1)	**7**
Fitzroy	Grass/crop finishers	0	100 (1)	**1**
	Feedlots	0	100 (1)	**1**
	Other	33 (1)	67 (2)	**3**
Mackay Whitsunday	Grass/crop finishers	100 (2)	0	**2**
	Feedlots	0	0	**0**
	Other	0	0	**0**

3.1.3.2 Slaughter Cattle

Please note for this table and others in this section the 'Other' category was removed due to a lack of data. Similarly, there was only one reported value for the 'Organic market' in the Fitzroy for slaughter cows; one respondent sent 100% of their slaughter cows to the organic market.

Table 9: Percentage of enterprises selling to slaughter steer/bullocks markets (Number of enterprises in parenthesis)

Catchments	Markets	0-99% of turnoff	100% of turnoff	Number of enterprises
Burnett Mary	Domestic	86 (6)	14 (1)	**7**
	Jap	53 (8)	47 (7)	**15**
	EU	86 (6)	14 (1)	**7**
	US	100 (1)	0	**1**
Burdekin	Domestic	89 (16)	11 (2)	**18**
	Jap	72 (31)	28 (12)	**43**
	EU	25 (1)	75 (3)	**4**
	US	86 (12)	14 (2)	**14**
Fitzroy	Domestic	94 (16)	6 (1)	**17**
	Jap	73 (35)	27 (13)	**48**
	EU	53 (8)	47 (7)	**15**
	US	100 (6)	0	**6**
Mackay Whitsunday	Domestic	100 (1)	0	**1**
	Jap	60 (3)	40 (2)	**5**
	EU	0	0	**0**
	US	100 (1)	0	**1**
Wet Tropics	Domestic	50 (1)	50 (1)	**2**
	Jap	100 (1)	0	**1**
	EU	0	0	**0**
	US	0	0	**0**

Table 10: Percentage of enterprises selling to slaughter heifers markets (Number of enterprises in parenthesis)

Catchment	Markets	0-99% of turnoff	100% of turnoff	Number of enterprises
Burnett Mary	Domestic	79 (15)	21 (4)	**19**
	Jap	88 (7)	12 (1)	**8**
	EU	100 (6)	0	**6**
	US	0	0	**0**
Burdekin	Domestic	54 (13)	46 (11)	**24**
	Jap	100 (3)	0	**3**
	EU	100 (4)	0	**4**
	US	50 (4)	50 (4)	**8**
Fitzroy	Domestic	59 (23)	41 (16)	**39**
	Jap	88 (7)	12 (1)	**8**
	EU	83 (10)	17 (2)	**12**
	US	67 (2)	33 (1)	**3**
Mackay Whitsunday	Domestic	33 (1)	67 (2)	**3**
	Jap	0	0	**0**
	EU	0	0	**0**
	US	0	0	**0**
Wet Tropics	Domestic	100 (1)	0	**1**
	Jap	100 (1)	0	**1**
	EU	0	0	**0**
	US	0	0	**0**

Table 11: Percentage of enterprises selling to slaughter cows markets (Number of enterprises in parenthesis)

Catchment	Market	0-99% of turnoff	100% of turnoff	Number of enterprises
Burnett Mary	Domestic	100 (3)	0	**3**
	Jap	0	0	**0**
	EU	100 (1)	0	**1**
	US	20 (9)	80 (36)	**45**
Burdekin	Domestic	29 (4)	71 (10)	**14**
	Jap	100 (2)	0	**2**
	EU	25 (1)	75 (3)	**4**
	US	18 (10)	82 (46)	**56**
Fitzroy	Domestic	60 (3)	40 (2)	**5**
	Jap	100 (1)	0	**1**
	EU	75 (3)	25 (1)	**4**
	US	17 (12)	83 (57)	**69**
Mackay Whitsunday	Domestic	67 (2)	33 (1)	**3**
	Jap	100 (1)	0	**1**
	EU	0	0	**0**
	US	75 (9)	25 (3)	**12**
Wet Tropics	Domestic	0	0	**0**
	Jap	0	100 (1)	**1**
	EU	0	0	**0**
	US	0	0	**0**

3.1.4 MSA grading

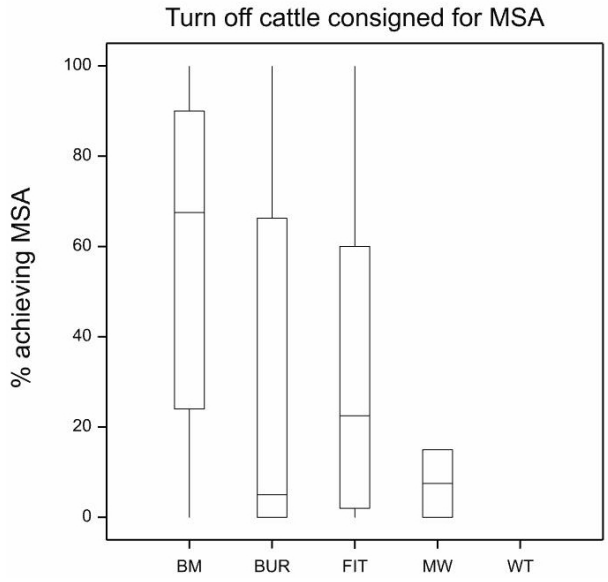
Question: Out of your turnoff cattle consigned for MSA grading what percentage achieved MSA?

Enterprises were asked to indicate what percentage turnoff cattle consigned for MSA grading achieved MSA grading (Table 12 and Figure 2). Results below are indicated as a mean and median of percentage of turnoff which achieved MSA compliance. It is not the percentage of enterprises which consigned their cattle MSA. It is unclear whether these figures represent percentage compliance before or after company specification compliance, or whether this is only the percentage of cattle achieving premium boning groups. There were no responses for the Wet Tropics.

Table 12: Percentage of cattle consigned to MSA market which met MSA specifications

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Mean MSA compliance	57	29	33	8	0
Median MSA compliance	68	5	22	8	0
Number of enterprises	**20**	**25**	**50**	**2**	**0**

Figure 2: MSA Compliance



3.1.5 Average weight and age of cattle sold in the last 12 months

Question: What was the average weight and age of cattle sold in the last 12 months (heifers, steers, cull cows)?

Enterprises indicated what the average weight and age of turnoff cattle sold in the last 12 months was for the different markets (Table 13 to Table 20). For this question the data represents the average weight and age of cattle sold annually (over the last 12 months) during the survey period from 2011-14. Results are presented in Table 13 to Table 20 and should be interpreted as per the following example. In Table 13, the survey showed that the annual average carcass/dressed weight of steers sold to slaughter in the Burnett Mary was 329 kilograms. Twenty-seven enterprises responded to this

question. In Table 14 the annual average age of steers sold to slaughter in the Burnett Mary was approximately 30 months, similarly 27 enterprises answered this question and gave information specific to this cattle class and market. It should be noted that enterprises may not have provided both an average weight and average age. For example in Table 15, 10 enterprises indicated an average weight for cull cows while only six gave an average age for cull cows in Table 16.

3.1.5.1 Slaughter cattle sales

Table 13: Average annual carcass weight (kg) of slaughter cattle sold (Number of enterprises in parenthesis)

Average weight (dressed)	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Steers (kg)	329 (27)	340 (57)	346 (61)	317 (12)	500 (1)
Heifers (kg)	285 (28)	268 (33)	278 (52)	257 (3)	400 (1)
Cull cows (kg)	305 (37)	275 (69)	315 (69)	274 (12)	500 (1)

Table 14: Average annual age of slaughter cattle (months) sold (Number of enterprises in parenthesis)

Average age	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Steers (mths)	30 (27)	35 (56)	31 (60)	53 (11)	24 (1)
Heifers (mths)	37 (27)	28 (33)	26 (50)	60 (4)	24 (1)
Cull cows (mths)	102 (23)	103 (59)	92 (67)	95 (9)	0

3.1.5.2 Sale yard cattle sales

Table 15: Average annual live weight (kg) of cattle sold in sale yards (Number of enterprises in parenthesis)

Average weight (live)	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Steers (kg)	317 (19)	318 (17)	360 (15)	286 (11)	490 (1)
Heifers (kg)	307 (16)	277 (19)	305 (19)	248 (8)	350 (1)
Cull cows (kg)	474 (10)	450 (9)	483 (5)	393 (3)	0

Table 16: Average annual age (months) of cattle sold in sale yards (Number of enterprises in parenthesis)

Average age	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Steers (mths)	17 (19)	16 (16)	18 (15)	14 (11)	30 (1)
Heifers (mths)	17 (16)	16 (19)	17 (19)	21 (8)	30 (1)
Cull cows (mths)	95 (6)	111 (7)	79 (4)	75 (2)	0

3.1.5.3 Live export market sales

Table 17: Average annual live weight (kg) of cattle sold to live export (Number of enterprises in parenthesis)

Average weight (live)	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Steers (kg)	0	330 (13)	0	0	0
Heifers (kg)	0	300 (14)	0	0	390 (1)

Table 18: Average annual age (months) of cattle sold to live export (Number of enterprises in parenthesis)

Average age	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Steers (mths)	0	24 (12)	0	0	0
Heifers (mths)	0	21 (13)	0	0	0

3.1.5.4 Paddock/ other live weight cattle sales

Table 19: Average annual live weight (kg) of cattle sold through paddock/ other sales (Number of enterprises in parenthesis)

Average weight (live)	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Steers (kg)	338 (11)	309 (22)	344 (21)	208 (3)	0
Heifers (kg)	257 (8)	286 (19)	326 (18)	178 (3)	300 (1)
Cull cows (kg)	0	410 (5)	495 (2)	0	0

Table 20: Average annual age (months) of cattle sold through paddock/ other sales (Number of enterprises in parenthesis)

Average age	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Steers (mths)	25 (10)	19 (19)	21 (20)	14 (2)	0
Heifers (mths)	25 (7)	19 (14)	19 (18)	12 (2)	18 (1)
Cull cows (mths)	0	60 (2)	150 (1)	120 (1)	0

3.1.6 Average sale numbers over the past five years

Question: What were your average sale numbers over the past five years (Males and Females)?

For this question the results represent the average sale numbers over the last five years (Table 21, Table 22). This question captures sale numbers from approximately 2007 to 2014 (the suvey began in 2011; five years prior would be 2007). Results are presented in Table 21 and Table 22 and can be interpreted as in the following example. In the Burnett Mary, enterprises sold 801 males and 665 females on average over the past five years, which represented 57% and 43% respectively of the total sales. Forty-five Burnett Mary enterprises answered this question.

Table 21: Total and average number of male and female cattle sold over the past five years (average annual sales in parenthesis)

Catchment	Total sales over past 5 years		Average annual sales over past 5 years	
	Male	Female	Male	Female
Burnett Mary	801 (45)	665 (45)	160	133
Burdekin	3178 (66)	2609 (67)	636	522
Fitzroy	2516 (78)	1460 (72)	503	292
Mackay Whitsunday	306 (16)	308 (14)	61	62
Wet Tropics	450 (2)	325 (2)	90	65

Table 22: Male and female cattle sales as a percentage of total sales over the last five years

Catchment	Male sales percentage	Female sales percentage	Number of responses
Burnett Mary	57	43	45
Burdekin	56	44	65
Fitzroy	56	44	71
Mackay Whitsunday	56	44	14
Wet Tropics	55	45	2

3.2 Weaner management

3.2.1 Summary

Average weaning rates ranged from 50% in breeders not segregated by age in the Burdekin to 88% in the Burnett Mary in first calf heifers. Minimum weaning weight was highest in the Wet Tropics (250kg) in good seasons and in bad seasons (200kg). The Burdekin recorded the lowest minimum weaning weight average for both good (176kg) and bad (128kg) seasons.

3.2.2 Minimum weaning weights

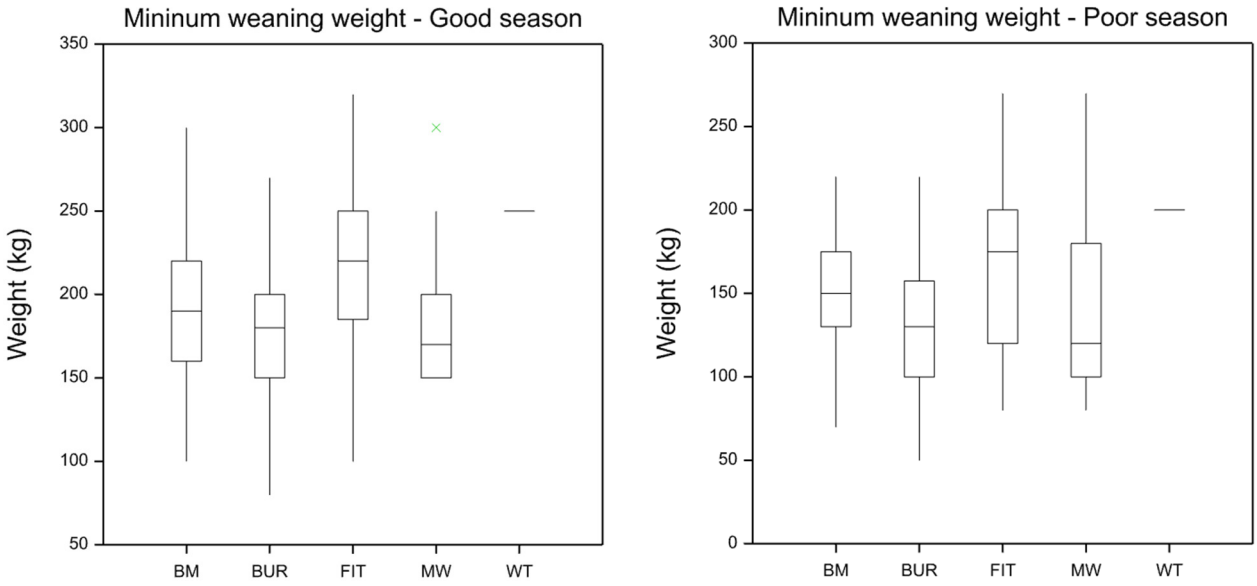
Question: Minimum weight that calves are weaned at in good and poor seasons (kg)

Enterprises were asked to indicate the minimum age that calves are weaned at in good and poor seasons. Table 23 shows the average (mean minimum) weaning weight data for both good and poor seasons and can be interpreted as in the following example. In the Burnett Mary, average weaning weight was 188 kilograms in good seasons and 151 kilograms in poor seasons. The number in parenthesis represents the number of enterprises. Note, not all enterprises provided an average weight for poor seasons. Figure 3 shows the range of weaning weights in good and poor seasons through quartiles and medians of each catchment.

Table 23: Minimum weaning weights (kg) in good and poor seasons (mean) (Number of enterprises in parenthesis)

	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Good season (kg)	188 (46)	176 (74)	221 (84)	184 (14)	250 (1)
Poor season (kg)	151 (44)	128 (71)	166 (84)	138 (14)	200 (1)
Number of enterprises	**46**	**74**	**84**	**14**	**1**

Figure 3: Mean minimum weaning weights (kg) in good and poor seasons



3.2.3 Weaning percentage

Question: What were the weaning numbers for the following classes of females?

Enterprises were asked to indicate the 2011 and 2012 weaning percentages for replacement heifers, first calf heifers, breeders and breeders that were not segregated by age. Reponses were categorised into replacement heifers (females weaning their first calf), first calf heifers (heifers weaning their second calf) and mature breeders (females weaning their third or subsequent calf). A separate category was also used for enterprises which did not segregate breeding females into age groups or did not have weaner numbers for different breeder age groups. It should be noted that enterprises could answer multiple times and therefore only the total number of responses are presented in parenthesis rather than the number of enterprises that were surveyed.

Data was collected for the 2011 and 2012 weaning and is represented in Table 24 and Table 25 respectively. Interpretation of the tables is per the following example. For 2011 in the Burnett Mary, the median weaning rate was 75% for replacement heifers. Seventeen enterprises provided a weaning rate for this cattle class. Figure 4: 2011 median weaning percentage ranges by breeder category and catchment and Figure 5: 2012 show the median and range of weaning rates for 2011 and 2012 respectively, by category and catchment. Figure 6 provides a median and range of weaning rates for all combined breeders for 2011 and 2012. Weaning rate was defined as calves weaned divided by cows mated.

Table 24: 2011 median weaning percentages for different breeder age groups (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %
Replacement heifers	75 (17)	60 (25)	77 (22)	0
First calf heifers	88 (6)	69 (13)	70 (12)	0
Breeders	85 (14)	70 (21)	84 (18)	69 (3)
Breeders not segregated by age	79 (8)	50 (9)	80 (20)	73 (6)
Number of responses	**45**	**68**	**72**	**9**

Figure 4: 2011 median weaning percentage ranges by breeder category and catchment

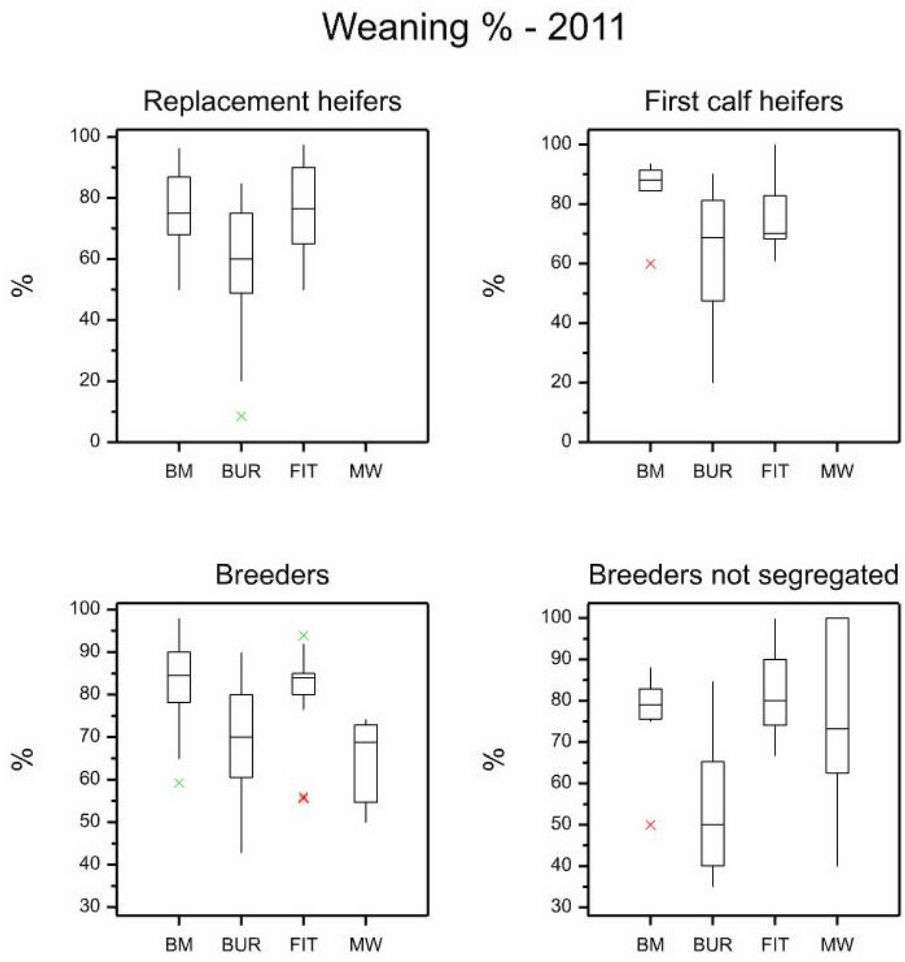


Table 25: 2012 median weaning percentages for different breeder age groups (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %
Replacement heifers	83 (12)	66 (29)	80 (28)	0
First calf heifers	87 (2)	55 (13)	70 (17)	0
Breeders	82 (10)	71 (23)	85 (22)	69 (2)
Breeders not segregated by age	75 (7)	66 (11)	85 (14)	67 (4)
Number of responses	**31**	**76**	**81**	**6**

Figure 5: 2012 median weaning percentage ranges by breeder category and catchment

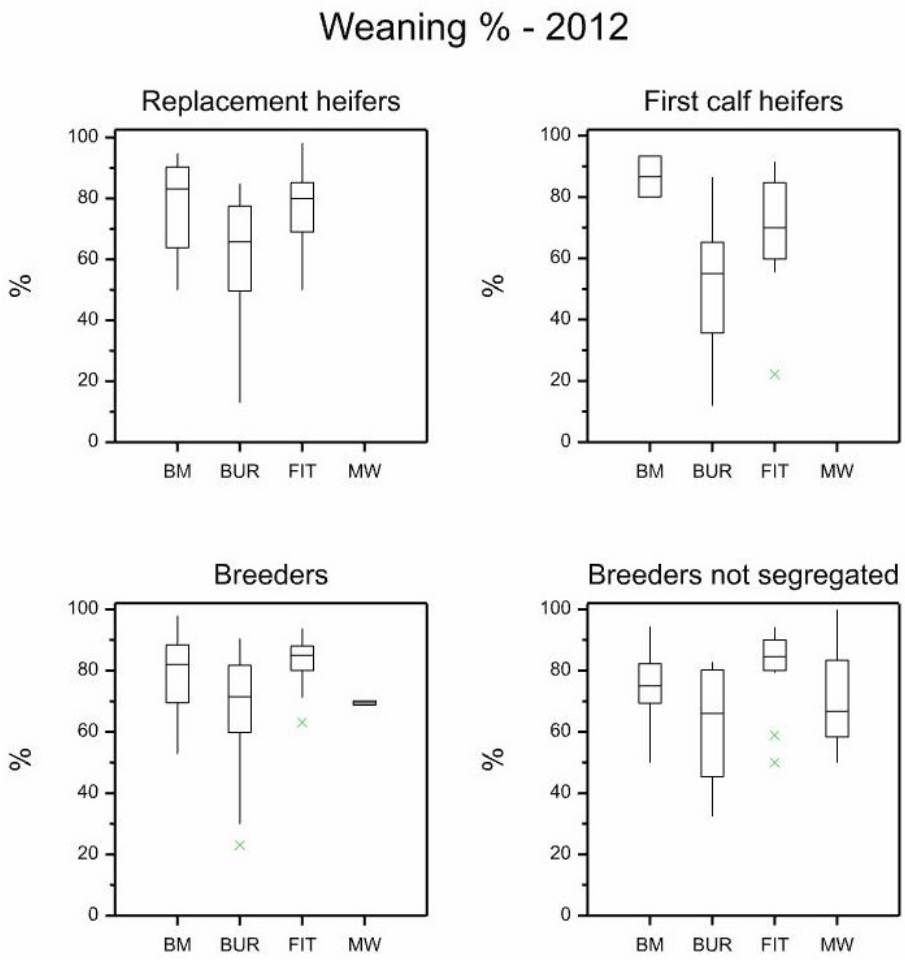
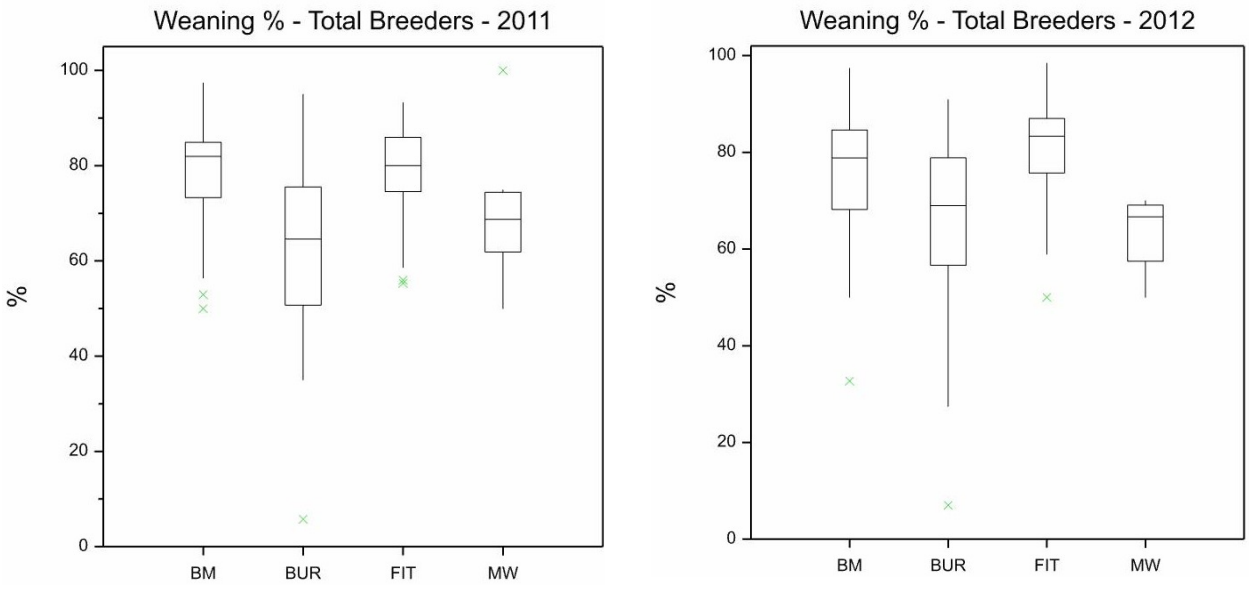


Figure 6: Median weaning percentage ranges for all breeding females by catchment and year



3.3 Heifer management

3.3.1 Summary

The most common practice across catchments was to manage replacement females (heifers) separately. Thirty-two percent of enterprises managed heifers until their first joining and 24% of enterprises managed heifers separately until after weaning their first calf. Only 11% of enterprises managed heifers until after the weaning of their second calf. This is consistent across catchments. Not managing heifers separately had the largest range across catchments, with 5% of enterprises in the Burdekin using this strategy and 29% in the Mackay Whitsunday.

The most common joining practice, regardless of catchment or age of first joining, was to join 100% of the heifers of an age group. Half of enterprises across catchments joined heifers between 18 and 24 months, 32% of enterprises joined between 12 and 18 months and 18% joined heifers older than 24 months. There was some tendency to join heifers at different ages in the Burdekin and Fitzroy catchments.

In the Burnett Mary and Burdekin 28% and 52% of enterprises were more inclined to join heifers at 250-300kg while in the Fitzroy, 56% of enterprises joined heifers at >300kg. Overall, 7% of enterprises across catchments joined heifers between 200-250kg, 45% joined at 250-300kg and 48% joined at >300kg.

3.3.2 Management of replacement females as a separate group

Question: Do you manage replacement females as separate group from your main breeder herd?

Enterprises were asked to indicate if they managed replacement females as a separate group from the main breeder herd. Results are displayed in Table 26 below. The table should be interpreted as per the following example. In the Burnett Mary, 29% of enterprises managed replacement heifers until after the weaning of the heifers first calf. The number in parenthesis is the number of enterprises.

Table 26: Segregation management of replacement females (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
After weaning of first calf	29 (13)	28 (23)	22 (19)	5 (1)	100 (2)
After weaning of second calf	7 (3)	17 (14)	12 (10)	0	0
Until start of first joining	31 (14)	30 (25)	29 (25)	52 (11)	0
Until start of second joining	20 (9)	20 (17)	18 (15)	14 (3)	0
Don't manage separately	13 (6)	5 (4)	19 (16)	29 (6)	0
Number of enterprises	**45**	**83**	**85**	**21**	**2**

3.3.3 Age range of heifers when first joined

Question asked enterprises to fill in a table, including weight and age of heifers at the time of first joining.

Enterprises indicated at what age they joined their heifers. Responses are summarized in Table 27. The table shows the total number of enterprises that responded to joining some percentage (anywhere from 1 – 100%) of their heifers in the various age ranges. The table can be interpreted as follows. In the Burnett Mary a total of 14 enterprises joined some percentage of heifers when they were 12-18 months of age.

Table 27: Age range of heifers when first joined

Age range (months)	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
12-18	14	20	43	7	0
18-24	28	52	44	6	2
>24	5	29	6	9	0

The table below shows what percentage (number in parenthesis) of the numbers above had 100% of heifers joined at the respective age range. Thus, for the Burnet Mary, of the 28 enterprises that responded to having some percentage of their heifers joined between 18 and 24 months, 26 or 93% of the enterprises joined 100% of their heifers at this age range.

Table 28: Percentage of enterprises joining 100% of heifers at certain ages (Number of enterprises in parenthesis)

Age range (months)	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
12-18	100 (14)	55 (11)	84 (36)	100 (7)	0
18-24	93 (26)	75 (39)	77 (34)	100 (6)	100 (2)
>24	80 (4)	79 (23)	50 (3)	100 (9)	0

3.3.4 Weight range of heifers when first joined

Question asked enterprises to fill in a table, including weight and age of heifers at the time of first joining.

Enterprises indicated at what weight they joined heifers. Results are displayed below (Table 29). The table is interpreted as in the following example. In the Burnett Mary, 50% of enterprises joined less than 50% of their heifers when they were between 200 and 250 kilograms. In the Burdekin, 59% of enterprises joined 100% or all of their heifers at 300kg or more. The number in parenthesis represents the number of enterprises.

Table 29: Weight of heifers at first joining (Number of enterprises in parenthesis)

Catchment	Weight range (kg)	Percentage of heifers joined			Number of enterprises
		0-49%	50-99%	100%	
Burnett Mary	200-250	50 (2)	50 (2)	0	**4**
	250-300	25 (7)	14 (4)	61 (17)	**28**
	>300	8 (2)	27 (7)	65 (17)	**26**
Burdekin	200-250	56 (5)	11 (1)	33 (3)	**9**
	250-300	8 (4)	40 (21)	52 (27)	**52**
	>300	16 (8)	24 (12)	59 (29)	**49**
Fitzroy	200-250	0	50 (2)	50 (2)	**4**
	250-300	12 (5)	30 (12)	58 (23)	**40**
	>300	14 (8)	12 (7)	73 (41)	**56**
Mackay Whitsunday	200-250	0	40 (2)	60 (3)	**5**
	250-300	0	18 (2)	82 (9)	**11**
	>300	0	0	100 (7)	**7**
Wet Tropics	200-250	0	0	0	**0**
	250-300	0	100 (1)	0	**1**
	>300	0	50 (1)	50 (1)	**2**

3.4 Breeder management

3.4.1 Summary

Controlled mating of breeders was the most common practice across all catchments, except the Mackay Whitsunday. Enterprises in the Burnett Mary (87%) were more likely to use controlled breeding, followed by the Fitzroy (68%) and Burdekin (53%). Overall, the percentage of enterprises which control mated breeders (62%) and 1st lactation heifers (62%) were similar, however, more enterprises control mated maiden heifer's (72%).

The percentage of enterprises using pregnancy testing was as follows: Burnett Mary (81%), Burdekin (86%), Fitzroy (83%), and Mackay Whitsunday (58%). The most common pregnancy-testing practice across all catchments was to test all cows and dry cows.

3.4.2 Current joining management for breeder herd

Question: Describe the current joining management for your breeder herd.

Enterprises were asked to fill out a table describing joining strategies for maiden heifers (Table 30), 1st lactation females (Table 31) and breeders (

Table 32). Tables should be interpreted as follows. In the Burnett Mary, 13% of enterprises continuously mated maiden heifers and 87% controlled mated maiden heifers. The number in parenthesis represents the number of enterprises.

Table 30: Joining management for maiden heifers (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Continuous mating	13 (5)	30 (26)	25 (18)	58 (11)	50 (1)
Controlled mating	87 (33)	70 (60)	75 (55)	42 (8)	50 (1)
Number of enterprises	**38**	**86**	**73**	**19**	**2**

Table 31: Joining management for first lactation females (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Continuous mating	19 (5)	46 (36)	32 (23)	59 (10)	100 (1)
Controlled mating	81 (22)	54 (43)	68 (48)	41 (7)	0
Number of enterprises	**27**	**79**	**71**	**17**	**1**

Table 32: Joining management for breeders (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Continuous mating	24 (11)	47 (40)	32 (26)	55 (12)	100 (2)
Controlled mating	76 (35)	53 (45)	68 (56)	45 (10)	0
Number of enterprises	**46**	**85**	**82**	**22**	**2**

3.4.3 Use of pregnancy testing

Question: Is pregnancy testing a normal yearly practice? Enterprises were asked to fill in a table.

Enterprises indicated whether pregnancy testing was a normal yearly practice and what classes of females were tested. The results are displayed in Table 33 and can be interpreted as follows. In the Burnett Mary, 19% of enterprises do not use pregnancy testing and 60% pregnancy test all cows. The number in parenthesis represents the number of enterprises.

Table 33: Pregnancy testing use on various classes of females (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
No	19 (9)	14 (16)	17 (20)	42 (15)	0
Yes - for all cows	60 (28)	25 (29)	36 (41)	14 (5)	0
Yes - for cull cows	6 (3)	14 (16)	10 (12)	11 (4)	50 (1)
Yes - for dry cows	13 (6)	24 (28)	23 (26)	22 (8)	0
Yes - for heifers	2 (1)	25 (29)	14 (16)	11 (4)	50 (1)
Number of enterprises	**47**	**118**	**115**	**36**	**2**

3.5 Bull management and selection

3.5.1 Summary

Bull breeding soundness examinations (BBSE) were used by the majority of enterprises across catchments, ranging from 72% of enterprises in the Burnett Mary to 43% in the Mackay Whitsundays and over 50% for the other catchments. The percentage of bulls to females ranged from 2.5% in the Wet Tropics to 3.4% in the Burdekin.

Brahman, Droughtmaster, and Santa Gertrudis bulls were the most commonly purchased *Bos indicus* bulls. For *Bos taurus* bull breeds, Angus bulls were the most commonly purchased and Belmont Red bulls were the most commonly purchased for composites and crossbreeds.

Estimated breeding values (EBVs) were used by around a half of enterprises across most catchments, except the Mackay Whitsundays where only 20% of enterprises used EBVs. Most users of EBVs had a moderate level of understanding. The top five EBV's across all catchments, in order of priority, were; 400 day weight, 600-day weight, birth weight, 200-day weight and scrotal size.

3.5.2 Bulls Breeding Soundness Evaluation (BBSE)

Question: Bulls assessed for breeding soundness BBSE? If so, when and how often?

Enterprises indicated if they used BBSE's and if so how often and when (Table 34, Table 35). The proportions shown in 'before purchase' and 'once every (x) years' are only in relation to those enterprises answering 'yes'. The table can be interpreted as in the following example. In the Burnett Mary, 72% of enterprises used BBSE (Table 34). Of the 72% of enterprises, 64% used BBSE before purchase and 36% used BBSE once every ('x' years) (Table 35). The number in parenthesis represents the number of enterprises.

Table 34: Use of BBSE by enterprises across catchments (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
No	28 (13)	43 (37)	39 (35)	57 (13)	50 (1)
Yes	72 (34)	57 (49)	61 (55)	43 (10)	50 (1)
Number of enterprises	**47**	**86**	**90**	**23**	**2**

Table 35: When do you use BBSE? (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Enterprises using BBSE before purchase	64 (21)	62 (30)	48 (26)	80 (8)	100 (1)
Enterprises using BBSE before and after purchase	36 (12)	38 (18)	52 (28)	20 (2)	0
Number of enterprises	**33**	**48**	**54**	**10**	**1**

3.5.3 Bull joining percentage

Question: What bull percentage do you aim to run?

Enterprises indicated what bull percentage they aimed to run (Table 36). Bull percentage is the number of bulls to females joined. Table 36 shows the mean of responses given across catchments by enterprises.

Table 36: Mean bull percentage used in enterprises' breeding herds by catchment

	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Mean bull percentage	2.9	3.4	3.2	2.7	2.5
Number of enterprises	**44**	**82**	**85**	**18**	**2**

3.5.4 Breeds of bulls purchased

Question: What breeds of bulls have you purchased over the last three years?

For this question the results represent the average number of bulls purchased by enterprises over the last three years. This question captures purchase numbers from approximatley 2009 to 2014 (the suvey began in 2011; three years prior would be 2009). Enterprises were asked to complete a table showing the number of bulls purchased by breed. The breeds were aggregated into three categories: Bos indicus, Bos taurus and Composites/ Crossbreds. Enterprises could choose as many breeds as applicable.

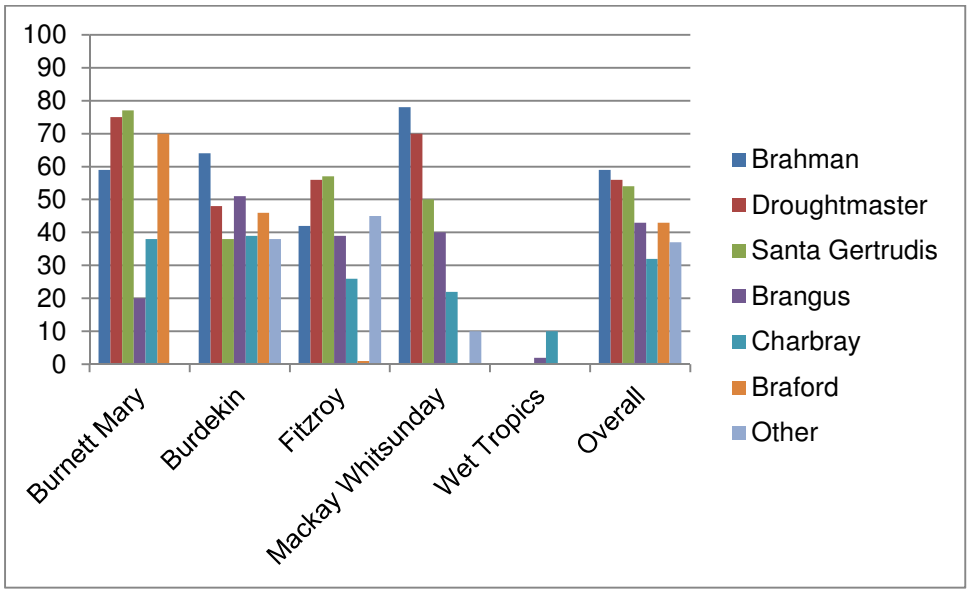
Results are shown in Table 37 through Table 39 and Figure 7 through to Figure 9. Tables should be interpreted as per the following example. In the Burnett Mary, eight enterprises indicated that of the bulls purchased, on average, 59% were Brahman.

3.5.4.1 Bos indicus

Table 37: Bos indicus breeds of bulls purchased over the previous three years (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %	Overall %
Brahman	59 (8)	64 (48)	42 (33)	78 (16)	0	**59 (105)**
Droughtmaster	75 (8)	48 (26)	56 (22)	70 (5)	0	**56 (61)**
Santa Gertrudis	77 (8)	38 (15)	57 (16)	50 (1)	0	**54 (40)**
Brangus	20 (2)	51 (15)	39 (11)	40 (5)	2 (1)	**43 (34)**
Charbray	38 (2)	39 (12)	26 (5)	22 (4)	10 (1)	**32 (24)**
Braford	70 (1)	46 (5)	1 (1)	0	0	**43 (7)**
Other	0	38 (4)	45 (3)	10 (1)	0	**37 (8)**

Figure 7: Bos indicus breeds of bulls purchased over the previous three years

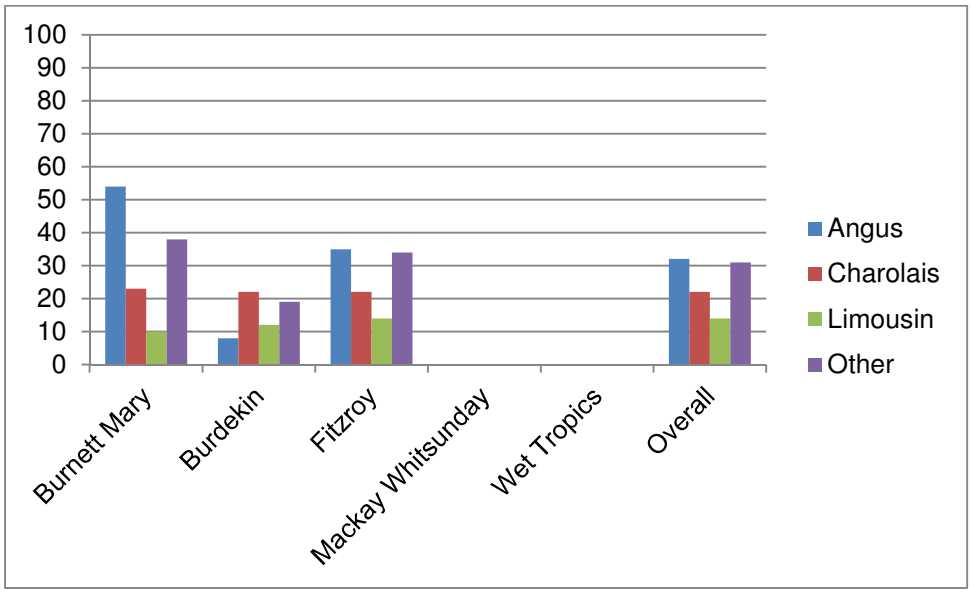


3.5.4.2 Bos taurus

Table 38: Bos taurus breeds of bulls purchased over the previous three years (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %	Overall %
Angus	54 (8)	8 (9)	35 (13)	0	0	**32 (30)**
Charolais	23 (3)	22 (15)	22 (12)	0	0	**22 (30)**
Limousin	10 (1)	12 (2)	14 (7)	0	0	**14 (10)**
Other	38 (5)	19 (7)	34 (16)	0	0	**31 (28)**

Figure 8: Bos taurus breeds of bulls purchased over the previous three years

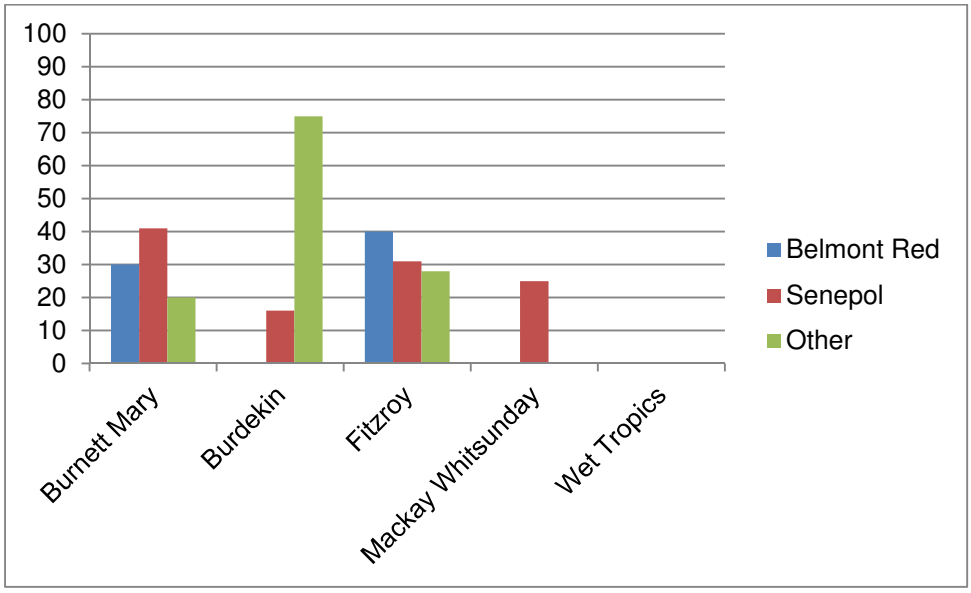


3.5.4.3 Composites/Crossbreeds

Table 39: Composites/crossbreeds of bulls purchased over the previous three years (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %	Overall %
Belmont Red	30 (1)	0	40 (4)	0	0	**38 (5)**
Senepol	41 (4)	16 (2)	31 (3)	25 (2)	0	**31 (11)**
Other	20 (1)	75 (2)	28 (3)	0	0	**42 (6)**

Figure 9: Composites/crossbreeds of bulls purchased over the previous three years



3.5.5 Use of EBVs when selecting bulls

Question: Do you use estimated breeding values (EBVs) when selecting bulls? If you do use EBVs, what is your level of understanding? 1=low, 5=high

Table 40 summarises the number of enterprises that use EBVs when selecting bulls by catchment. Enterprises who answered 'yes' to using EBV's were asked their level of understanding. Table 41 shows that of the enterprises that said 'yes' to the use of EBVs, 17% indicated they had a high (5) level of understanding. These results are also presented graphically in Figure 10.

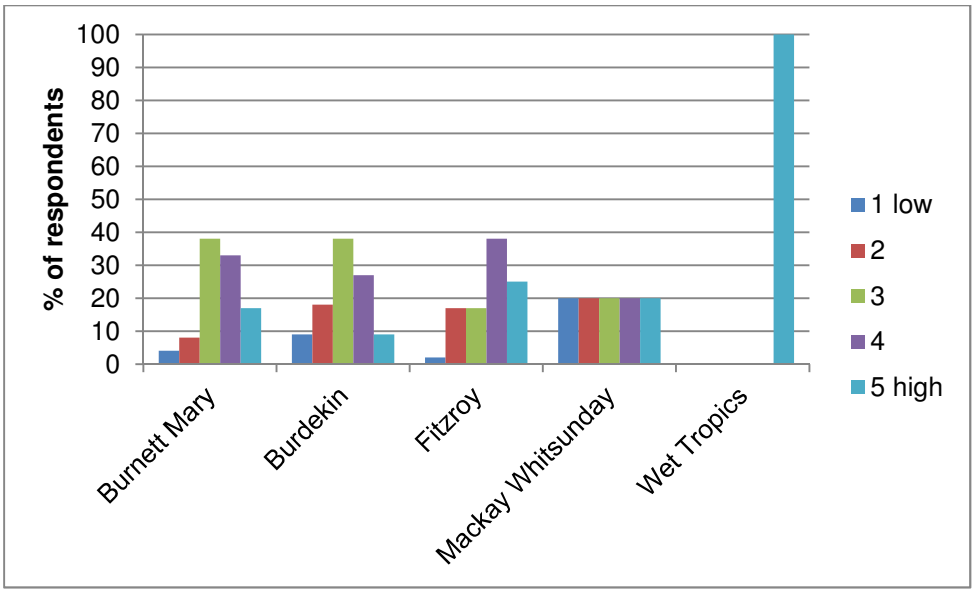
Table 40: Use of Estimated Breeding Values (EBVs) by enterprises (Number of enterprises in parenthesis)

	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
No (%)	49 (23)	47 (40)	42 (39)	80 (20)	0
Yes (%)	51 (24)	53 (46)	58 (53)	20 (5)	100 (2)
Number of enterprises	**47**	**86**	**92**	**25**	**2**

Table 41: Understanding of EBV (Number of enterprises in parenthesis)

If you do use EBVs, what is your level of understanding?	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
1 (low)	4 (1)	9 (4)	2 (1)	20 (1)	0
2	8 (2)	18 (8)	17 (9)	20 (1)	0
3	38 (9)	38 (17)	17 (9)	20 (1)	0
4	33 (8)	27 (12)	38 (20)	20 (1)	0
5 (high)	17 (4)	9 (4)	25 (13)	20 (1)	100 (1)
Number of enterprises	**24**	**45**	**52**	**5**	**1**

Figure 10: Understanding of EBVs



3.5.6 Most important EBV trait for producers in bull selection

Question: List your top 5 EBV traits

The responses shown in Table 42 represent the most important EBV traits as indicated by enterprises. The table can be interpreted as in the following example. In the Burnett Mary, 14% of enterprises listed the 200-day growth EBV as a top five priority.

Table 42: Top 5 EBV traits (Number of enterprises in parenthesis)

EBV	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
200 day growth	14 (9)	10 (16)	9 (19)	17 (2)	13 (1)
400 day weight	20 (13)	15 (23)	12 (25)	25 (3)	25 (2)
600 day weight	8 (5)	17 (26)	14 (28)	25 (3)	13 (1)
Birth Wt.	21 (14)	10 (15)	12 (24)	8 (1)	0

EBV	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Breed index	2 (1)	1 (1)	2 (4)	0	0
Calving ease	6 (4)	3 (4)	4 (8)	0	13 (1)
Carcase weight	0	3 (4)	4 (8)	0	0
Days to calving	5 (3)	9 (14)	4 (9)	0	13 (1)
Docility	0	5 (7)	5 (10)	0	0
Eye muscle area	8 (5)	6 (9)	6 (12)	17 (2)	13 (1)
Flight time	2 (1)	1 (2)	1 (2)	0	0
Gestation length	2 (1)	1 (1)	2 (4)	0	0
Intramuscular fat	0	1 (1)	1 (1)	0	0
Mature Cow	3 (2)	3 (5)	3 (6)	0	0
Milk	2 (1)	1 (1)	2 (5)	0	0
Net feed intake	0	0	1 (2)	0	0
Retail beef yield	0	1 (1)	1 (1)	0	0
Rib fat	0	1 (1)	5 (11)	8 (1)	0
Rump fat	3 (2)	3 (5)	3 (7)	0	0
Scrotal size	8 (5)	11 (17)	10 (2)	0	13 (1)
Number of responses	**66**	**154**	**206**	**12**	**8**

3.6 Health and nutrition (supplementary feed and vaccination)

3.6.1 Summary

Vaccination usage varied across classes of cattle and across catchments; The mostly commonly administered vaccines for each cattle class was as follows:

- Weaners: 5 in 1, 7 in 1 and botulism
- Replacement heifers and breeders: botulism, 7 in 1 and leptospirosis
- Bulls: Vibriosis and botulism

A large majority of enterprises fed cattle supplements across all catchments. Generally, dry season protein supplements were preferred to dry season energy and protein supplements for all cattle classes. This was consistent across catchments, except the Burnett Mary where enterprises preferred energy and protein supplements. During bad years, protein supplements were generally preferred across all catchments and cattle classes. The exception was weaners, where the preferred option was protein and energy supplements.

Across all catchments less than 15% of enterprises fed wet season phosphorous and fewer than 10% of enterprises fed wet season salt and sulphur. Supplement costs were similar in the Burdekin ($18/head) and Fitzroy ($17/head) and was highest in the Mackay Whitsunday ($42/head).

3.6.2 Health treatments

Enterprises were presented with a table reflecting Table 43 below and asked to respond with a tick (yes) or leave blank (no) for vaccinations and other health treatments used for different cattle classes. The data in the tables reflect the total enterprises surveyed within each catchment. Each respondent may have answered multiple times and therefore the numbers in parenthesis do not equal the total enterprises surveyed, but rather the number of enterprises that answered 'yes' to using particular vaccine. For example, In the Burnett Mary, 2% of enterprises (of the total 85 properties surveyed) vaccinated their weaners for botulism. There were two responses for this question (n=2).

Table 43: Percentage of enterprises giving vaccinations to weaners (Number of responses in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Botulism	2 (2)	44 (43)	16 (16)	32 (9)	1 (1)
5 in 1	36 (31)	31 (30)	53 (52)	11 (3)	0
7 in 1	20 (17)	26 (25)	26 (25)	46 (13)	1 (1)
Leptospirosis	1 (1)	2 (2)	5 (5)	4 (1)	0
Pestivirus	1 (1)	0	3 (3)	0	0
Tick Fever	24 (20)	19 (19)	28 (27)	0	0
Vibriosis	0	1 (1)	0	0	0
3 Day	1 (1)	0	2 (2)	4 (1)	0
Total enterprises surveyed	**85**	**98**	**98**	**28**	**125**

Table 44: Percentage of enterprises giving vaccinations to steers (Number of responses in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Botulism	5 (4)	34 (33)	5 (5)	11 (3)	1 (1)
5 in 1	7 (6)	6 (6)	11 (11)	7 (2)	0
7 in 1	2 (2)	2 (2)	2 (2)	7 (2)	1 (1)
Leptospirosis	0	1 (1)	1 (1)	0	0
Pestivirus	1 (1)	0	2 (2)	0	0
Tick Fever	5 (4)	7 (7)	4 (4)	4 (1)	0
Vibriosis					
3 Day	4 (3)	1 (1)	5 (5)	4 (1)	1 (1)
Total enterprises surveyed	**85**	**98**	**98**	**28**	**125**

Table 45: Percentage of enterprises giving vaccinations to replacement heifers (Number of responses in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Botulism	7 (6)	48 (47)	16 (16)	21 (6)	1 (1)
5 in 1	5 (4)	1 (1)	2 (2)	0	0
7 in 1	11 (9)	10 (10)	23 (23)	18 (5)	1 (1)
Leptospirosis	19 (16)	14 (14)	21 (21)	4 (1)	0
Pestivirus	13 (11)	1 (1)	12 (12)	0	0
Tick Fever	5 (4)	6 (6)	2 (2)	0	0
Vibriosis	2 (2)	2 (2)	6 (6)	0	0
3 Day	1 (1)	0	3 (3)	0	0
Total enterprises surveyed	**85**	**98**	**98**	**28**	**125**

Table 46: Percentage of enterprises giving vaccinations to breeders (Number of responses in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Botulism	6 (6)	51 (51)	22 (22)	36 (36)	1 (1)
5 in 1	2 (2)	0	1 (1)	0	0
7 in 1	6 (6)	7 (7)	10 (10)	11 (11)	1 (1)
Leptospirosis	18 (18)	8 (8)	27 (27)	11 (11)	0
Pestivirus	8 (8)	0	6 (6)	0	1 (1)
Tick Fever	2 (2)	3 (3)	0	0	0
Vibriosis	1 (1)	0	1 (1)	0	0
3 Day	1 (1)	0	1 (1)	0	0
Total enterprises surveyed	**85**	**98**	**98**	**28**	**125**

Table 47: Percentage of enterprises giving vaccinations to bulls (Number of responses in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Botulism	7 (7)	43 (43)	15 (15)	29 (29)	1 (1)
5 in 1	0	0	2 (2)	0	0
7 in 1	5 (5)	7 (7)	7 (7)	7 (7)	0
Leptospirosis	5 (5)	12 (12)	11 (11)	11 (11)	0
Pestivirus	6 (6)	3 (3)	10 (10)	0	0
Tick Fever	4 (4)	6 (6)	4 (4)	0	0
Vibriosis	24 (24)	28 (28)	35 (35)	14 (14)	2 (2)
3 Day	13 (13)	7 (7)	17 (17)	4 (4)	0
Total enterprises surveyed	**85**	**98**	**98**	**28**	**125**

3.6.3 Use of supplements

Question: 'Do you feed cattle supplements?' And, '*What classes of stock do you usually supplement*?'

Enterprises were provided with a table with categories of supplements (arranged vertically) fed across normal and poor seasons. Normal seasons were further divided into 'wet season' supplements and 'dry season' supplements.

Results are summarised from Table 48 through to Table 55. Tables should be interpreted as in the following example. For Table 48 in the Burnett Mary, 6% of enterprises do not feed cattle supplements. The number in parenthesis (3) is the number of responses.

Note: It is possible that producers who fed dry season supplements continued feeding the same quantity and type of supplement during bad years and may not have indicated any supplementation under 'bad years'. For this reason, overall supplement usage in the breakdown of seasons and years is not reported.

Table 48: Use of supplements (Number of enterprises in parenthesis)

	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
No (%)	6 (3)	1 (1)	11 (10)	12 (3)	0
Yes (%)	94 (46)	99 (86)	89 (84)	88 (22)	100 (2)
Number of enterprises	**49**	**87**	**94**	**25**	**2**

Table 49: Supplements given to all cattle (Number of responses in parenthesis)

Season/ supplements	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Bad Years - Energy & Protein	34 (12)	15 (18)	20 (17)	9 (2)	17 (1)
Bad Years - Protein	26 (9)	27 (33)	27 (23)	9 (2)	0
Dry Season - Energy & Protein	14 (5)	7 (8)	13 (11)	26 (6)	17 (1)
Dry Season - Protein	20 (7)	29 (36)	24 (20)	35 (8)	33 (2)
Wet Season - Phosphorus	3 (1)	16 (20)	6 (5)	13 (3)	33 (2)
Wet Season - Salt & Sulphur	3 (1)	6 (7)	1 (1)	9 (2)	0
Not applicable	0	1 (1)	8 (7)	0 (0)	0
Number of responses	**35**	**123**	**84**	**23**	**6**

Table 50: Supplements given to weaners (Number of responses in parenthesis)

Season/ supplements	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Bad Years - Energy & Protein	30 (13)	28 (24)	33 (15)	0	0
Bad Years - Protein	14 (6)	8 (7)	16 (7)	0	0
Dry Season - Energy & Protein	36 (16)	41 (35)	31 (14)	14 (1)	100 (1)
Dry Season - Protein	18 (8)	14 (12)	16 (7)	29 (2)	0
Wet Season - Phosphorus	2 (1)	8 (7)	4 (2)	43 (3)	0
Wet Season - Salt & Sulphur	0	0	0	14 (1)	0
Number of responses	**44**	**85**	**45**	**7**	**1**

Table 51: Supplements given to heifers (Number of responses in parenthesis)

Season/ supplements	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Bad Years - Energy & Protein	33 (15)	20 (16)	21 (14)	14 (2)	0
Bad Years - Protein	26 (12)	17 (14)	22 (15)	0	0
Dry Season - Energy & Protein	17 (8)	15 (12)	13 (9)	43 (6)	0
Dry Season - Protein	17 (8)	34 (28)	32 (22)	29 (4)	0
Wet Season - Phosphorus	7 (3)	12 (10)	10 (7)	14 (2)	0
Wet Season - Salt & Sulphur	0	2 (2)	1 (1)	0	0
Number of responses	**46**	**82**	**68**	**14**	**0**

Table 52: Supplements given to first calf heifers (Number of responses in parenthesis)

Season/ supplements	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Bad Years - Energy & Protein	37 (20)	19 (14)	20 (14)	14 (2)	0
Bad Years - Protein	22 (12)	18 (13)	25 (18)	0	0
Dry Season - Energy & Protein	17 (9)	15 (11)	13 (9)	43 (6)	100 (1)
Dry Season - Protein	19 (10)	32 (24)	31 (22)	21 (3)	0
Wet Season - Phosphorus	6 (3)	14 (10)	10 (7)	14 (2)	0
Wet Season - Salt & Sulphur	0	3 (2)	1 (1)	7 (1)	0
Number of responses	**54**	**74**	**71**	**14**	**1**

Table 53: Supplements given to breeders (Number of responses in parenthesis)

Season/ supplements	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Bad Years - Energy & Protein	34 (20)	14 (10)	20 (16)	15 (2)	0
Bad Years - Protein	22 (13)	21 (15)	24 (20)	0	0
Dry Season - Energy & Protein	17 (10)	5 (4)	7 (6)	38 (5)	0
Dry Season - Protein	20 (12)	42 (31)	35 (29)	23 (3)	0
Wet Season - Phosphorus	7 (4)	15 (11)	12 (10)	15 (2)	0
Wet Season - Salt & Sulphur	0	3 (2)	1 (1)	8 (1)	0
Number of responses	**59**	**73**	**82**	**13**	**0**

Table 54: Supplements given to steers (Number of responses in parenthesis)

Season/ supplements	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Bad Years - Energy & Protein	20 (1)	13 (4)	21 (6)	50 (2)	0
Bad Years - Protein	40 (2)	33 (10)	21 (6)	0	0
Dry Season - Energy & Protein	20 (1)	17 (5)	21 (6)	25 (1)	100 (1)
Dry Season - Protein	0	27 (8)	34 (10)	25 (1)	0
Wet Season - Phosphorus	0	3 (1)	3 (1)	0	0
Wet Season - Salt & Sulphur	0	7 (2)	0	0	0
Not applicable	20 (1)	0	0	0	0
Number of responses	**5**	**30**	**29**	**4**	**1**

Table 55: Supplements given to bulls (Number of responses in parenthesis)

Season/ supplements	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
Bad Years - Energy & Protein	37 (10)	16 (3)	18 (6)	100 (1)	0
Bad Years - Protein	22 (6)	21 (4)	21 (7)	0	0
Dry Season - Energy & Protein	11 (3)	16 (3)	18 (6)	0	0
Dry Season - Protein	26 (7)	37 (7)	36 (12)	0	0
Wet Season - Phosphorus	4 (1)	11 (2)	6 (2)	0	0
Number of responses	**27**	**19**	**33**	**1**	**0**

3.6.4 Cost of supplementation

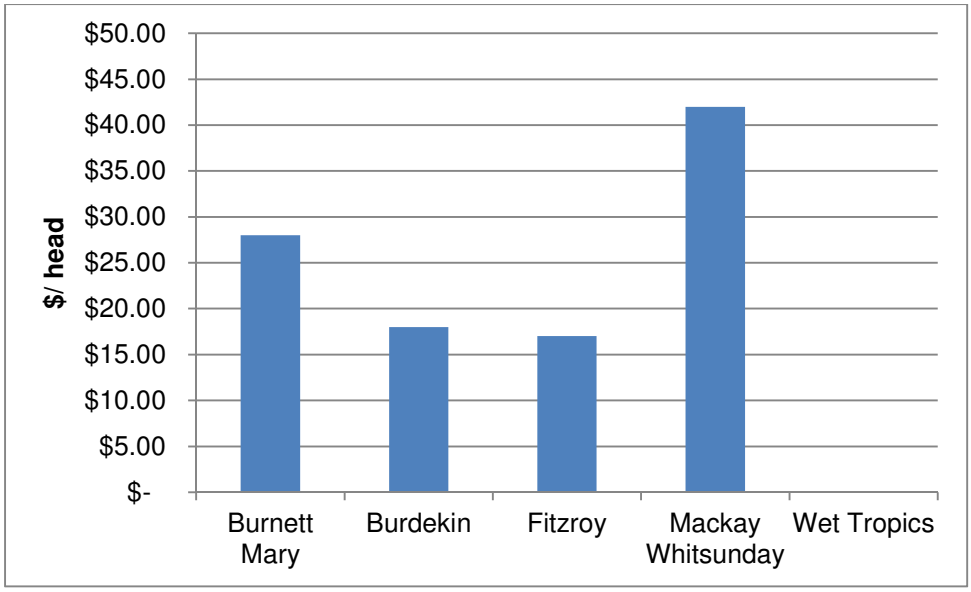
What is the average cost of supplementation? Total annual and per head.

Enterprises indicated what the average cost of stock supplementation was on a per head basis and annually (Table 56). The table can be interpreted as follows. In the Burnett Mary, the mean cost of supplementation was $28.00 per head and approximately $10,947.00 annually. Figure 11 indicates that on average, the Mackay Whitsundays had the highest mean per head supplementation cost.

Table 56: Total annual supplementation cost per head by region (Number of enterprises in parenthesis)

		Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Cost per head	**Mean**	$28.00	$18.00	$17.00	$42.00	0
	Number of enterprises	**6**	**43**	**25**	**3**	**0**
Annual property total	**Mean**	$10,947.00	$46,743.00	$23,044.00	$56,127.00	0
	Number of enterprises	**20**	**41**	**31**	**6**	**0**

Figure 11: Mean per head supplementation cost



3.7 Stock handling & record keeping

3.7.1 Summary

Across catchments, a large majority of enterprises (85%) did not use foetal aging. The Burdekin (16%) and Fitzroy (17%) had the highest usage rates of foetal aging, while Mackay Whitsunday (4%) had the lowest usage rate.

The majority of enterprises (65%) did not use individual animal performance data. Use of individual animal data was highest in the Fitzroy (46%) and lowest in the Mackay Whitsundays (4%). Of those using individual data, the most common method was with electronic identification (EID) ear tags and management tags (14%).

Weaners were the most commonly handled class of cattle and steers the least. On average, Burdekin enterprises handled 7,790 cattle annually at an average cost of $64,213. The Fitzroy handled 7,425 cattle annually at a cost of $30,221. Robust data was not able to be collected for other catchments.

3.7.2 Foetal aging

Question: Is foetal age data being recorded and used for management?

Enterprises indicated whether they used foetal aging (Table 57). The results should be interpreted as follows. In the Burnett Mary, 86% of enterprises recorded foetal age data. The number in parenthesis is the number of enterprises.

Table 57: Foetal age data recording (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
No	86 (38)	84 (72)	83 (75)	96 (24)	50 (1)
Yes	14 (6)	16 (14)	17 (15)	4 (1)	50 (1)
Number of enterprises	**44**	**86**	**90**	**25**	**2**

3.7.3 Individual animal performance data

Question: Do you use individual animal performance data?

Enterprises indicated if and how they collected animal performacen data (Table 58). The results should be interpreted as per the following example. In the Burnett Mary, 60% of enterprises reported that they did not use individual animal performance data, while 4% indiacted they did collect animal perfroamnce data using an EID ear tag. The number in parenthesis is the number of enterprises.

Table 58: Individual animal performance recording (Number of enterprises in parenthesis)

	Burnett Mary %	Burdekin %	Fitzroy %	Mackay Whitsunday %	Wet Tropics %
No	60 (29)	70 (60)	54 (51)	96 (24)	100 (2)
Yes - with EID ear tag	4 (2)	7 (6)	11 (10)	0	0
Yes - with EID ear tag and management tag	21 (10)	8 (7)	20 (19)	0	0
Yes - with management ear tags	15 (7)	15 (13)	15 (14)	4 (1)	0
Number of enterprises	**48**	**86**	**94**	**25**	**2**

3.7.4 Annual stock handling

Question: Number of times cattle were handled per year

Enterprises indicated how many times they handled different classes of stock annually (Table 59 through to Table 62). Results should be interpreted as per the following example. In the Burnett Mary, weaners were handled an average of six times; 43 enterprises answered this question.

Table 59: Mean number of times weaners were handled per year by region

	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Mean number of times handled	6	4	6	5	8
Number of enterprises	**43**	**86**	**87**	**16**	**2**

Table 60: Number of times heifers were handled per year by region

	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Mean number of times handled	5	3	4	5	8
Number of enterprises	**44**	**80**	**81**	**21**	**2**

Table 61: Number of times breeders were handled per year by region

	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Mean number of times handled	4	3	4	5	4
Number of enterprises	**46**	**85**	**84**	**20**	**2**

Table 62: Number of times steers were handled per year by region

	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Mean number of times handled	4	2	4	4	8
Number of enterprises	**41**	**77**	**81**	**15**	**2**

3.7.5 Annual mustering costs

Question: What were your mustering costs for the last year?

Enterprises indicated their annual mustering costs (Table 63). Results should be interpreted as per the following example. In the Burnett Mary, mean annual mustering costs averaged $27,227, with a sample size of 11.

Table 63: Mean annual mustering costs by region

	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Mean annual mustering cost ($)	$27,227.00	$64,213.00	$30,221.00	$5,450.00	0
Number of enterprises	**11**	**59**	**60**	**2**	**0**

3.7.6 Total number of cattle put through yards

Question: What was the total number of cattle put through your yards (annually)?

Enterprises indicated the total number of cattle put through the yards each year. Results in Table 64 should be interpreted as per the following example. In the Burnett Mary, the number of cattle put through the yards averaged 6,800 head, with a sample size of two.

Note: these numbers do not represent unique cattle, but include cattle handled multiple times.

Table 64: Total number of cattle put through yards annually

	Burnett Mary	Burdekin	Fitzroy	Mackay Whitsunday	Wet Tropics
Mean total number of cattle (head)	6,800	7,790	7,425	0	0
Number of enterprises	**2**	**40**	**34**	**0**	**0**

4.0 Comparison of the GMPA survey with other surveys

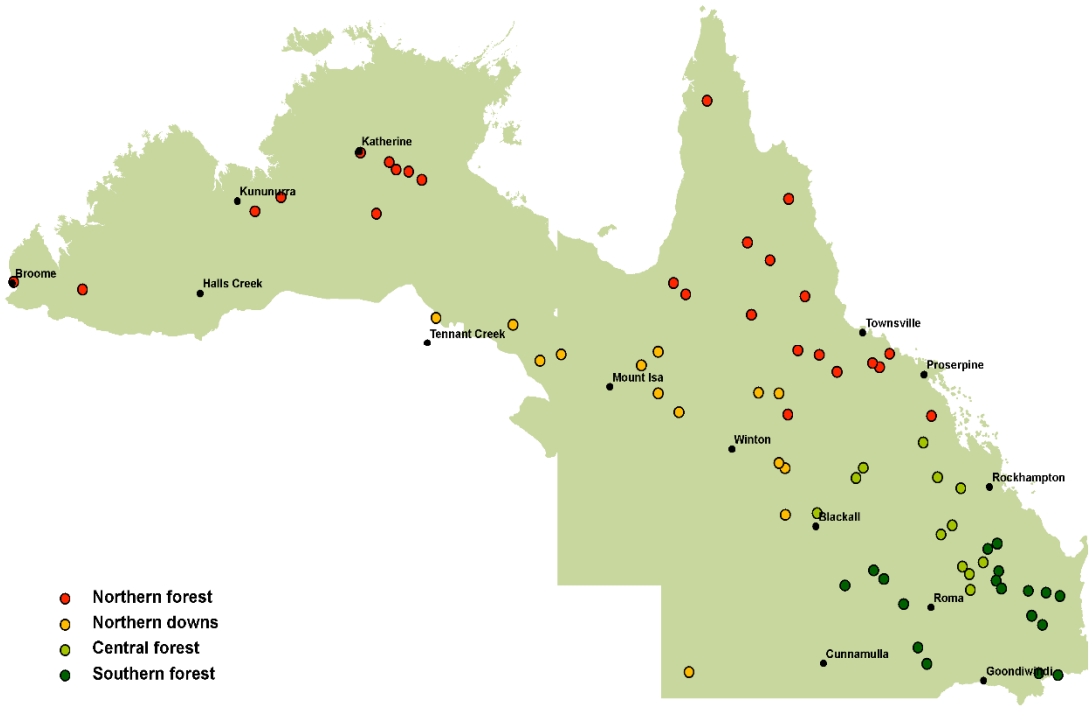
This section compares the results obtained from the Grazing Management Practice Adoption Survey - Herd Management (GMPA) with other surveys and research projects, conducted in the region. Specifically, surveys used to compare were: “North Australia Beef Producer Survey 1990” (NABPS) O'Rourke et al. (1992), the “Report on the Northern Australian Beef Industry Survey Activity - North Region Report” (NABIS) (Bortolussi et al., 2005a) and “Cashcow” (McGowan et al., 2014a).

While the earlier surveys do not exactly line up geographically with the GMPA survey, there is sufficient similarity to allow some comparisons to be made. Figure 12 and Figure 13 show the boundaries used for “Cashcow” and the NABPS, respectively. The map from NABIS was not able to be reproduced satisfactorily; however, the authors have provided descriptions for segmentation of regions. The following regions, as described by NABIS are the most applicable regions for comparison:

1) Brigalow – discrete areas in central and southern Queensland inland of the ranges with cleared Brigalow scrub.
2) Northern speargrass – sub-coastal and inland strip from Cooktown to Mackay with speargrass as the dominant species.

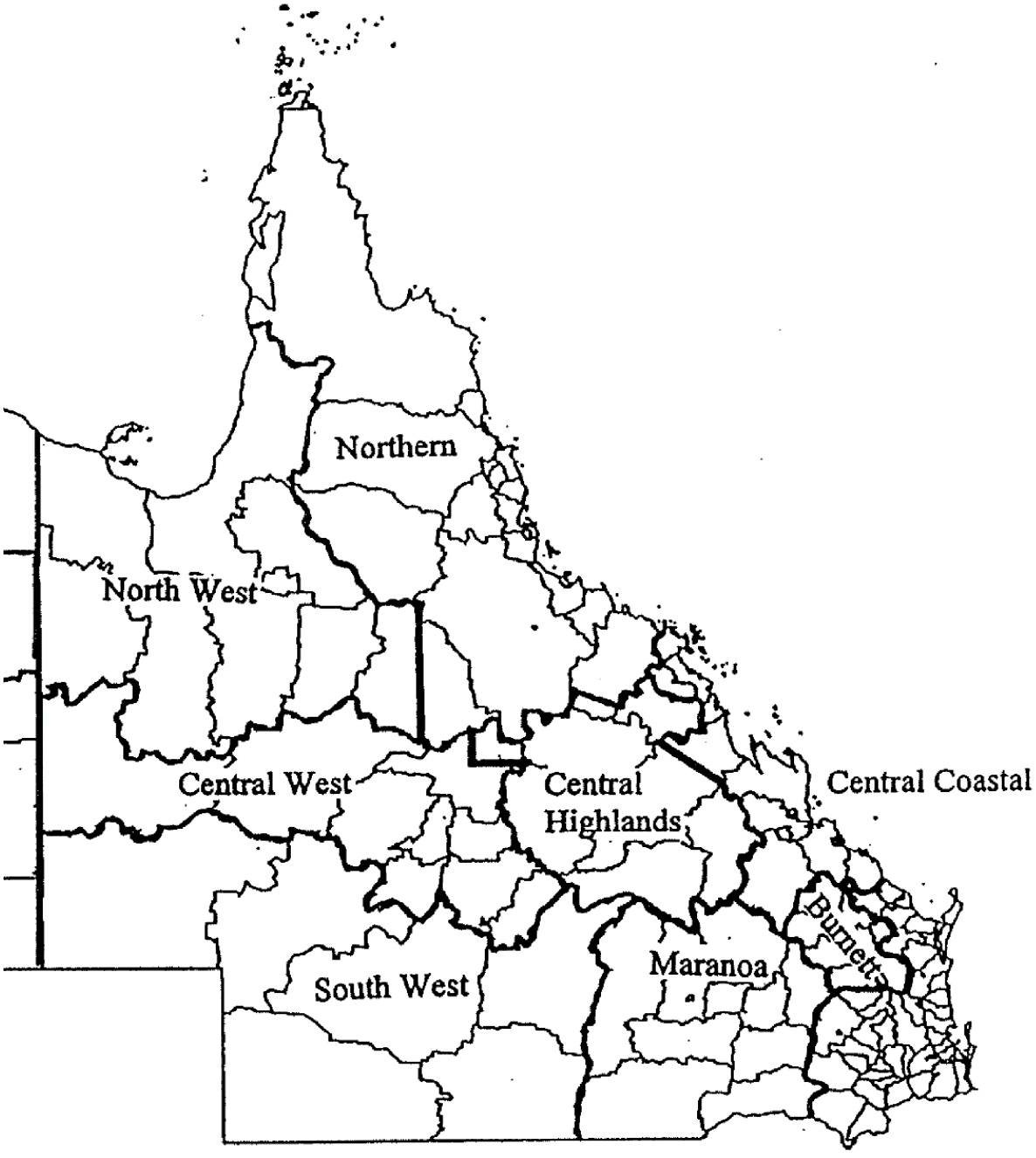
Not all questions can be compared with all surveys. As such, only relevant and directly comparable questions will be compared. Each comparison will be listed under a separate question heading with a comparison between results listed in a table.

Figure 12: Survey properties and corresponding regions as defined by "Cashcow"



Source: (McGowan et al., 2014b)

Figure 13: Regional boundaries for the CSIRO northern Australian beef industry survey activity. Adapted from Bortolussi et al. (2005a).



4.1 General discussion of comparable surveys

A number of quantifiable comparisons could be made between the four surveys. The directly comparable questions and data obtained are presented in Section 4.2. A number of qualitative comparisons could also be made between surveys, including the questions asked between older and newer surveys.

One of the key differences between surveys is the information that surveyors were seeking. This gives an indication of differences in management practices which were topical at the time of each survey, at least from the perspectives of those who were developing the surveys. There are many

qualitative examples that demonstrate major changes in the management practices and technology adopted by beef producers. An example of this is the frequent infrastructure questions asked in the 1990 NABPS. These questions included; boundary fencing, watering points, power sources for those waters, stock yards. The survey reflects that infrastructure development was still a major topical issue at this time. While there were still infrastructure questions asked in the NABIS, there were much fewer, with no mention of power sources. The GMPA Survey did ask similar questions in the grazing management component of the survey regarding fencing to land types and managing riparian and selectively grazed areas. This may be as designed but more likely reflects the expectation of survey developers that these critical infrastructures are in place or that the bulk of development is done. Either way, infrastructure development was not considered a major topical issue in the GMPA survey.

This theme extends to other questions and surveys. For instance, Bortolussi et al. (2005a) asks “do you wean?”. This suggests that weaning may or may not be done, whereas the GMPA survey asks “what is the minimum weight calves are weaned?” This implies that weaning occurs and that the actual weaning management practice is the focus rather than the act of weaning itself. Another example is the use of hormone growth promotants (HGPs). Earlier surveys asked whether HGPs were used; on the other hand, there is no mention of HGP use in the GMPA survey. This may reflect expectations they are being used, or may reflect the growing number of markets which do not accept HGP’s. In hindsight the GMPA survey should have had a HGP question as there had been a major change in the industry practice which would have been good to capture and document. Again, it appears that the relative importance of HGPs in the production system is not as large as it was in earlier surveys. Both earlier surveys also ask a number of detailed questions around pasture improvement such as sown species. This is also absent in the most recent GMPA survey.

While it is possible that the omission of certain topics were an oversight of the recent GMPA survey, it is just as likely that the relative importance of such information is lower than it had been previously. It is clear through the wording and intention of questions asked that the focus in most cases is not if management practices are being done, but how they are being done. Despite these differences, there are a number of directly comparable questions asked between all surveys, from the 1990 survey through to the 2011 – 2014 survey.

4.2 Directly comparable questions between surveys.

This section provides comparisons between surveys where the same or similar questions were asked. Some data was re-categorised from surveys to allow comparison. Notes for each change are presented under the relevant table. The comparisons are shown below, between Table 65 and Table 73.

Table 65: Property size and cattle carried for GMPA and comparison surveys' properties

Catchment	Burdekin (GMPA)	Fitzroy (GMPA)	NABIS (Northern)	NABPS	Cashcow
Property size (ha)	22,300*	7,100*	68,320**	29,269**	125,000** (Northern Forrest.) 16,800** (Central Forrest)
Cattle carried	3,650*	1,800*	4,881**	2,565* (Northern Spear) 1,343* (Brigalow.)	3,700**[1] (Northern Forrest) 1,200**[1] (Central Forrest)

*Median Value
** Mean value
[1]Cashcow project only reported number of breeding females

Table 66: Percentage of properties running breeders for GMPA and comparison surveys' properties

Catchment	Burdekin (GMPA)	Fitzroy (GMPA)	NABIS (Northern)	NABPS	Cashcow
Percentage of properties running breeders	88%	87%	97%	97% (Northern speargrass) 89% (Brigalow)	100%*

* Cashcow project only included breeding properties.

Table 67: Mean weaning weight for GMPA and comparison surveys' properties

Catchment	Burdekin (GMPA)	Fitzroy (GMPA)	NABIS (Northern)	NABPS	Cashcow
Mean weaning weight (kg)	176*	221*	170	N/A	163

*described as average minimum weaning weight

Table 68: Mean bull joining percentage for GMPA and comparison surveys' properties

Catchment	Burdekin (GMPA)	Fitzroy (GMPA)	NABIS (Northern)	NABPS	Cashcow
Mean bull joining percentage	3.4%	3.2%	N/A	4.1	~3.1%*(Northern forest) ~2.9%* (Central forest)

*Adapted weighted average data, using 2%, 3% and 4% as discrete substitutes for ranges presented in Cashcow report.

Table 69: Mean weaning or branding percentage of mature breeders for GMPA and comparison surveys' properties

Catchment	Burdekin (GMPA)	Fitzroy (GMPA)	NABIS (Northern)	NABPS	Cashcow
Mean weaning or branding percentage	70% (2011) 71% (2012)	84% (2011) 85% (2012)	66%*	60.3%*	54% (Northern forest) 83% (Central forest)

*Branding percentage

Table 70 - Mean heifer weaning rates for GMPA and comparison surveys' properties

Catchment	Burdekin (GMPA)	Fitzroy (GMPA)	NABIS (Northern)	NABPS	Cashcow
Mean weaning percentage	66% (2011) 60% (2012)	84% (2011) 77% (2012)	N/A	N/A	55%* (Northern forest) 67%* (Central forest)

*reclassified from >7 months mating to continuous mating.

Table 71: Percentage of GMPA and comparison surveys' properties using controlled or continuous mating

Catchment	Burdekin (GMPA)	Fitzroy (GMPA)	NABIS (Northern)	NABPS	Cashcow
Continuous	47%	32%	N/A	97%	47%* (Northern forest) 0%* (Central forest)
Controlled	53%	68%	N/A	3%	53%* (Northern forest)100%* (Central forest)

*reclassified from >7 months mating to continuous.

Table 72: Percentage of GMPA and comparison surveys' properties feeding phosphorous

Catchment	Burdekin (GMPA)	Fitzroy (GMPA)	NABIS (Northern)	NABPS (Northern speargrass	Cashcow
% feeding phosphorous	15% (breeders) 16% (all cattle)	12% (breeders) 6% (all cattle)	N/A	89% (deficient)* 64% (all other)	N/A

*this refers to the number of enterprises who had phosphorus (P) deficient country who were feeding P.

Table 73: Percentage of GMPA and comparison surveys' properties supplying store, slaughter and live export markets

Catchment	All catchments (GMPA)	NABIS (Northern)	NABPS	Cashcow
Store market	35%	55%*	N/A	N/A
Slaughter market	52%	36%*/**	N/A	N/A
Live export market	9%	9%*	No properties surveyed in the Northern speargrass or Brigalow regions sold cattle for live export	N/A

*Proportion of all cattle.
** Figure across all survey locations.

5.0 Discussion

The aim of this project was to collect and report on data relating to the productivity and management practices of grazing enterprises in the catchments adjacent to the Great Barrier Reef. This project collected data relating to markets and turnoff, weaner, heifer, breeder and bull management and selection, animal health and nutrition and stock handling and record keeping. The report has provided an industry benchmark for which future research, development and extension can utilise to target specific practices to improve the overall productivity of the grazing industry and reduce the impact of the grazing industry on end of catchment water quality. This discussion section was formulated through presentation of the results to industry experts. These experts provided what they considered to be topical issues arising from the results.

The main enterprise type was breed and finish mainly slaughter cattle and breeding and selling store cattle. This is consistent with findings from Bortolussi et al. (2005b). Overall about 1% of surveyed properties ran stud and seedstock breeding enterprises; considerably less than the 25% reported by Bortolussi et al. (2005b). This indicates a significant decline in the number of stud and seedstock enterprises. In the Burdekin the number of grazing businesses that sold store breeders was lower than expected based on feedback from industry experts.

Survey results indicated a relatively low MSA compliance rate, especially in the Fitzroy. There was also a large spread in the number of grazing businesses achieving MSA compliance in the Burdekin. This is most likely due to the large variance in the productivity of land types within the Burdekin leading to a large variation in compliance levels. There also appears to be a level of uncertainty regarding the context and interpretation of 'MSA compliance' amongst graziers in all catchments. However it was unclear whether the results obtained from the survey represented the percentage compliance before or after company specification compliance, or whether the figures represented the percentage of cattle achieving premium boning groups. Regardless, the major beef producing regions, the Fitzroy and Burdekin, had low compliance rates. Educating graziers about the compliance specifications for not just MSA but other premium markets can increase the overall profitability of grazing enterprises. Further, it aligns to the Meat Industry Strategic Plans' (MISP) goal of improving quality and compliance via enhanced supply chain information (RMAC, 2015). In future surveys, graziers should be asked specific questions relating to their understanding of MSA.

Survey results indicated that most grazing businesses understand and have accepted the age of turn off extension message; a basic strategy that has been adopted widely among most graziers. The next logical step for graziers is to increase the number of lead cattle in their herd to meet market compliance. The results obtained from this survey may demonstrate why there has been an increased interest and attendance at MSA field days in the Burdekin. It is suggested that extension should focus on how to educate and resource graziers to improve their ability to meet market compliance. Increasing the focus on marketing and compliance, rather than rehashing the age of turnoff story, which while is important, will have diminishing returns on adoption.

The Burdekin and the Fitzroy catchments had the largest percentage of mean average sales for both males and females. Female and male sales numbers can indicate the percentage of mortalities. In a steady state herd, one which is not building numbers or destocking and has no mortalities, the ratio of male to females sales is assumed to be 1:1 (50% males: 50% females). Therefore in a given herd which builds and destocks, the difference between 50% and the recorded female sales percentage is likely to be equivalent to the percentage of mortalities. For example in the Burnett Mary the mean number of females sold was 43% suggesting, if there are no large variances in herd numbers, mortalities may be as high as 7%. Due to a survey design fault no specific data relating to mortality is presented. In future, surveys should collect mortality rates from graziers to provide actual estimates of mortality rates among grazing business in each catchment.

For most of the surveyed catchments minimum weaning weights for calves in both good and poor seasons were higher than those reported in Bortolussi et al. (2005c). The improvements in weaning weights may be attributed to improved management of weaners over the last decade. However, the reported minimum weaning weights for calves in the Burdekin, 176kg in a good season and 128kg in a poor season, were higher than expected based on feedback from industry experts. In Bortolussi et al. (2005c) the minimum weight that calves were weaned at for northern Queensland, which encompasses the Burdekin catchment, was 100kg. Bortolussi et al. (2005c) did not specify if this figure was indicative of a poor or good season. Regardless, the minimum weaning rate of 100kg is lower than both figures recorded during this survey. This supports the expectation of industry experts mentioned previously.

In future, surveys should collect the age in months of weaners when they are weaned and if weaning is done only once or in two rounds. There is a strong message, particularly in the Burdekin, that graziers are not taking into consideration the body condition of their breeders and implementing early weaning strategies in order to boost breeder herd productivity. Appropriate management of weaners that takes into consideration breeder body condition can increase productivity and reduce the number of mortalities. This has a benefit to wider animal welfare outcomes, which is a key outcome of both MISP strategic plan and the NABRC RD&E prospectus (NABRC, 2012). Extension needs to be targeted towards understanding breeder body condition and the impacts that weaning can have on the reproductive performance of breeders in following seasons.

Weaning rates appeared to be higher than expected for 2011, particularly for first calf heifers. This may be due to:

- poor season preceding weaning this year
- producer estimations may have been based on long term averages rather than the poorer season experienced
- intensive use of supplementation, although we cannot confidently support this as we did not ask about supplementation in regards to breeders.

Results indicated that many grazing business are not segregating first calf heifers from the main breeder herd for management purposes. This is reflected by the low number of enterprises using segregation across all catchments for both 2011 and 2012. Sample size in the Burnett Mary and the Mackay Whitsundays for 2011 and 2012 was small and therefore reduces data confidence for those catchments.

Enterprises that did segregate their breeding herd by age consistently had higher weaning rates than enterprises which did not segregate. This is due to their ability to tailor management to the separate breeder groups. This ensures that each group, particularly replacement and first calf heifers, is receiving adequate nutrition to reach mature body weight and maintain body condition. Extension needs to continue to inform graziers that breeders segregated by age are able to receive better management of critical aspects, such as supplementation and body condition score. As a result breeders are more productive the following season, which improves enterprise productivity. This survey data backs up a key RD&E priorities identified in the NABRC RD&E Prospectus (NABRC, 2012).

A small proportion of grazing businesses across all catchments indicated separate management of replacement females. As outlined in the animal production module of Grazing BMP, industry standard is states that replacement (maiden) heifers should be run as a separate group until after their second mating (Department of Agriculture Fisheries and Forestry, 2014).This allows them to receive targeted management and gives them the best opportunity to reconceive again.

Results suggest that there are only a small number of enterprises who use recommended joining practices regarding weights and age of heifers (Shatz, 2012, Tyler et al., 2012). The assumption is

that not many graziers are aware of the optimum weight that heifers should be joined at (i.e. 65% of mature body weight). RD&E needs to target improved management of young females in order to improve productivity and reduce stocking rates. Management of young breeders is key to improving herd performance and if managed effectively, can reduce stocking rates.

Results indicated that current bull percentages used in the Burdekin and Fitzroy were lower than expected but were still higher than recommended joining percentage (Meat & Livestock Australia Limited, 2011). These results suggest that the uptake of extension messages which promote the lowering of bull percentages are being adopted, however, there is scope for improvement. For example, in the Burdekin the recommended bull percentage to use is 2%; the survey results indicate the average bull percentage in the Burdekin to be 3.4%. This should be a fairly simple practice to change overtime. Furthermore, the long held belief about bulls not being able to service cows due to geography has been debunked by research (Department of Primary Industries, 2003). Extension needs to focus on increasing the understanding of bull selection and management options which will provide graziers with the confidence to reduce bull percentages.

The increase in the types of bull breeds purchased indicates that many enterprises are attempting to improve market compliance through cross breeding. Further research should be undertaken into the economic advantages associated with cross breeding and subsequent market compliance to inform best practice information. Extension needs to provide graziers with the resources and support to investigate the benefits of cross breeding to achieve market compliance specifications such as MSA.

Rapid dissemination of superior genetics is the first goal of the NABRC RD&E prospectus priorities, which advocates the use of EBV technologies to achieve this (NABRC, 2012). All catchments indicated a higher than expected use of BBSE's and EBV's. This may be due to confusion between BBSE and EBV technologies. The fact that producers also predominantly look at growth/weight related EBV's suggest that they are trying to improve their specifications in relation to specific markets, and perhaps breeder fertility is akin to this. Therefore extension needs to extend the importance of breeder fertility and market compliance information and provide quantified evidence that targeting high growth EBV's (400 day and 600 day weight) will indeed result in a younger turnoff age for animals which will ultimately increase market compliance. More extension is required to improve the level of understanding among graziers about what the different technologies are and which part of the bull selection decision making process they play a part in.

Survey results have indicated low use of tick fever vaccinations, and low Vibriosis vaccination rates for bulls, particularly in the Fitzroy based on consultation with industry experts. Similarly results indicated 3 day and leptospirosis vaccination rates were low in breeders across all catchments. Bortolussi et al. (2005c) reported botulism vaccination rates for bulls averaged 67% compared to 43% shown by this survey, indicating a decline in the number of enterprises vaccinating bulls. Bortolussi et al. (2005c) also recorded a 29% vaccination rate for Vibriosis in bulls compared with 28% reported in this survey. Bortolussi et al. (2005c) estimated breeder vaccination rates for leptospirosis in the NQ region (Burdekin catchment) to be 10% for heifers and breeders. Results from this survey estimate the number of grazing businesses vaccinating heifers and breeders for leptospirosis to be 14% and 8% respectively. This indicates that vaccination rates for leptospirosis in heifers have increased, while vaccination rates from breeders have decreased.

All vaccinations need to be considered on a case-by-case basis and take into consideration the land type and location, especially in catchments like the Fitzroy. There is the potential for herd losses and/or disease outbreaks with such low vaccination rates for critical diseases. The broad benefits of animal welfare to the industry has been described in the RMAC's MISP (2015) as having the highest cost-benefit ratio (>20:1) of all possible RD&E commitments possible in the beef industry. Therefore, extension needs to focus on educating graziers about the importance and benefits of vaccinating their stock and the human health risks associated with working with unvaccinated stock.

Survey results have identified opportunities for improvements in wet season phosphorus and sulphur supplementation especially for breeders and heifers in the Fitzroy and Burdekin catchments. However this survey did not collect the time and duration of supplementation of stock. Low supplementation results suggest that extension is required to educate graziers on the benefits and reasons why they need to supplement stock with wet season phosphorus and sulphur in order to improve breeder body condition. Increased profitability of northern beef enterprises through improved supplementation practices is one of the key goals of the NABRC RDE prospectus and thus, should be a focus in extension programs.

The use of foetal aging by enterprises across all catchments was low. The low results suggest that foetal aging may be underutilised, especially on heifers. It is difficult to identify a pregnancy problem if enterprises are not foetal aging. Graziers need to be educated on the benefits of foetal aging to improve productivity by identifying pregnancy problems. Extension needs to be targeted at increasing productivity through the use of tools like this.

Survey results indicated that enterprises were handling and mustering stock numerous times throughout the year. This may reflect the number of continuously mated herds that muster two to three times a year meaning cattle are handled more often or the uptake of intensively managed grazing systems. Handling cattle incurs production costs and therefore graziers need to be more efficient regarding when and how often they are handling and mustering stock.

This project aimed to capture and report on the productivity and management practices of grazing enterprises in the Great Barrier Reef Catchments. The need for better data relating to the productivity and management of grazing lands has been an ongoing issue, more so recently due to the decline in reef health and the association between management and productivity of grazing lands and increased levels of sediment run-off. This data will allow industry, private organisations such as NRM groups, and government bodies to have a clearer understanding of the current management practices of the beef industry and identify priority areas that require more support in the form of extension and funding.

7.0 Appendix

7.1 List of key terms and definitions

Some of these key terms and definitions were taken directly from McGowan et al. (2014a) and Chudleigh et al. (n.d).

Average: Total divided by the number of observations. This may be similar or very different to the median.

BBSE: Bull breeding soundness evaluation. This is an evaluation process that assesses bulls against standards for physical and reproductive soundness. A critical component is sperm morphology to determine the percentage normal sperm in the semen sample.

Body condition score: Subjective assessment of the body tissue (fat and muscle) reserves of an animal. Five-point scale (1=poor 2= backward 3=moderate 4=forward/good 5=fat).

Bos indicus: Sub-species of cattle originating in tropical southern Asia. Brahmans are derived predominately from *Bos indicus* cattle.

Bos taurus: Sub-species of cattle originating in Europe, and includes British and continental breeds.

Botulism: Lethal disease that presents as flaccid paralysis. Caused by very common bacteria (same family as tetanus and blackleg) that produce extremely deadly toxins. The toxins are usually consumed when cattle develop depraved appetites and chew bones and carcases. Botulism most commonly occurs on phosphorus deficient country. Animals can also develop depraved appetites under very poor seasonal conditions.

Box and Whisker plots: A graphic demonstration of data distribution. The whiskers indicate extreme values. The central box extremities are the 25th and 75th percentiles. The box midline is the median.

Branding rate: defined as calves branded as a percentage of cows mated the previous year. It is very similar to weaning rate, but does not include calf mortality between branding and weaning.

Breeder: Synonym for cow in a breeding herd.

Bull: Entire male cattle.

Bullock: Steer after it reaches mature height and weight.

BVDV/Pestivirus: Bovine viral diarrhoea virus or bovine Pestivirus. Common viral infection of cattle. Infection of naïve unvaccinated cattle around the time of mating and during gestation may result in reduced pregnancy rates and increased percentage of losses between pregnancy diagnosis and weaning.

Central Forest: Forested areas associated with the Brigalow areas of central Queensland.

Confidence intervals: Values calculated in statistical analyses are estimates based on one set of measurements. The range within which 95% of estimates would occur if recalculated from independent sets of measurements is called the confidence interval.

Controlled mating: Non-continuous mating. The longest controlled mating is 7 months. Five months may allow mating after first weaning. Three months enables most calving to be completed before the next mating. Six weeks enables a maximum pregnancy rate of 90% in healthy cycling beef heifers and cows.

Cow: Female cattle after first mating, whether non-pregnant or from mid-pregnancy.

EBV: Estimated breeding value: An unbiased estimate of the genetic merit for a specified trait in relation to breed average when first published. Each EBV has an accuracy estimate indicating the likely range that the true value is within.

EID: Electronic identification device. An implant or tag containing an RFID.

Enterprise: Enterprise denotes the production of a particular commodity or group of related commodities for direct sale, thus by 'wheat enterprise' we imply the production and sale of a wheat crop but do not specify the method of production.

Extension: Provision of alternate information and skills to primary producers and support of appropriate integration to improve their business.

First-lactation cow: Cow during the period when the majority of her cohort is experiencing their first lactation.

Head (of): Colloquial term for number of cattle. Almost always can be excluded without loss of meaning.

Heifer: Young cohort of female cattle up to the time the majority should have calved, after which the cohort is classed as first-lactation cows.

Interquartile: The range between the 25th and 75th percentiles.

Key Performance Indicators (KPI's*):* Key performance indicators (KPI's) are tracking indicators used to measure the achievement of outputs against targets.

Maiden heifer: Heifer prior to first mating.

Mature cow: Cow after the time when her cohort has weaned their second age group of calves.

Mean: Synonym for average.

Median: Point where half the population is higher and half is lower = 50th percentile.

Mortality rate: Cattle that have died as a percentage of the number known to be alive at a previous time.

NIRS: Near-infrared reflectance spectroscopy. A system of using light bands absorbed/reflected from a sample material to describe its properties. Digestibility and crude protein levels of cattle diets can be estimated from NIRS of a dried faecal sample.

NLIS: National Livestock Identification Scheme. Animals are given an EID that has a unique external printed number and matching unique internal electronic number.

Northern Australia: Queensland, the Northern Territory, Pilbara, and Kimberley regions of Western Australia.

Northern Downs: Downs (naturally non-forested with black soil) areas of western Queensland, the Barkly Tableland, and Kimberley.

Northern Forest: Non-downs areas, north of a line from approximately Bowen to Karratha.

Percentage points: When comparing the difference(s) between percentages for each measure of performance the absolute difference will be expressed in terms of percentage point's increase or decrease. For example, the median percentage foetal/calf loss was 8 percentage points higher in cows in the Northern Forest (13%) compared to cows in the Southern Forest (5%).

Percentile: Demarcation point for a specified percentage of a population; e.g., 75th percentile is the point below which there is 75% of the population.

Pestivirus: See BVDV.

Phosphorous: Element, most of which is found in the body in cell membranes, the body's energy storage system, and in bone.

Quartile: A range within which 25% of animals occur.

Research: Scientific discovery and assessment of new methods built on hypotheses and using biometrics.

Second-lactation cow: A cow between confirmed pregnancy and weaning in the year after the majority of her cohort weaned their first calf.

Southern Forest: Non-downs areas outside the Brigalow country of southern Queensland.

Standard deviation: Statistic for a normally (evenly) distributed population whereby approximately two-thirds are within one standard deviation of the average and 95% are within two standard deviations of the average.

Steer: De-sexed bull prior to full maturity.

Supplement: Addition to the diet to balance primary deficiencies, speeding up digestion, thereby increasing the rate of pasture consumption, thus energy intake.

Three-day sickness: Common name for BEF.

Tick fever: Deadly disease caused by protozoan parasites (Babesia and Anaplasma) that damage red blood cells. Spread by cattle ticks. Infected young cattle are not affected and become immune.

Vaccine: Injectable (usually) product that causes development of immunity against an antigen, usually an infectious disease agent.

Vibriosis: The revised name is Campylobacterosis, derived from the infective agent's scientific genus name, Campylobacter. Infection of unvaccinated naïve females usually results in marked reduction in pregnancy rate but there may also be an increase in abortion rate. No clinical disease in bulls.

Weaner: Calf permanently prevented from suckling its dam at the end of the reproductive cycle.

Weaning rate (mated cows): Cows weaning a calf as a percentage of those mated the previous year. Usually difficult to calculate as herd restructures and culling during pregnancy often prevents accurate information being available. Can be derived from multiplying annual pregnancy rate by (1-foetal and calf loss rate).

Weaning rate (retained cows): Cows weaning a calf as a percentage of cows retained within a group.

Weight: Measure of body mass. Actual weight can be very precise, but weight recorded will vary with different weighing protocols, especially diet and time since eating and drinking.

7.2 Herd Management Survey

PART 2: Herd Management (Optional)

51. Which best describes your cattle enterprises? (What enterprises do you operate on your property?)

- ☐ Stud breeding/Seedstock
- ☐ Breeding and selling store cattle
- ☐ Breed and finish mainly slaughter cattle
- ☐ Growing/finishing transferred/purchased store cattle
- ☐ Other

52. What % of your turnoff went to the following markets? 2012(Clarification sought on how to report this table – Steers out of 100%; Heifers out of 100%; Cows our of 100%)

Market	Steers	Heifers	Cows
Stores			
Grass/crop finishers			
Feedlots			
Live Export			
Other (specify below)			
Slaughter Cattle			
Domestic			
Jap			
EU			
US			
Organic			
Other (specify below)			

53. Out of your turn off cattle consigned for MSA grading what percentage achieved MSA?
_____%

54. What was the average weight and age of cattle sold in the last 12 months?

Market	Weight (kg)	Age (months)
Slaughter cattle (carcass wt)		
steers		
heifers		
cull cows		
Saleyards (live wt)		
steers		
heifers		
cull cows		
Live Export (live wt)		
steers		
heifers		
Paddock/Other (live wt)		
steers		
heifers		
cull cows		

55. Do you manage replacement females as separate group from your main breeder herd?

- ☐ Don't manage separately
- ☐ Until start of 1st joining
- ☐ Until start of 2nd joining
- ☐ After weaning of first calf
- ☐ After weaning of second calf

56. What is the approximate age range of your heifers when you join them for the first time?
Please indicate % in each box

12 – 18 months	18 – 24 months	>24 months

57. What is the approximate weight range of your heifers when you join them for the first time?
Please indicate % in each box

200 – 250kg	250 – 300kg	>300kg

58. What were the weaning numbers for the following classes of females for the last two years?

	Mating to produce Year No 0 (2010) calves		Mating to produce Year No 1 (2011) calves	
	Females mated 2008/9 mating	Calves weaned 2010	Females mated 2009/10 mating	Calves weaned 2011
Replacement heifers (1st mating, 1st calf weaned)				
First calf cows (2nd mating, 2nd calf weaned)				
Breeders (3rd and subsequent mating)				
Breeders not segregated by age				
Total				

☐ Information not available

59. What are your sale numbers over the last 5 years?

Males_____ **Females**_____

60. What is the minimum weight that calves are weaned? If answer is provided in a scale format, it is not averaged – the lower weight is taken as the "minimum weight". *Answers to be in whole numbers only.*

Good season - Weight _____kg

Poor Season - Weight _____kg

61. Please describe the current joining management for your breeder herd, ie. Do you use continuous (bulls stay in all year) or controlled (bulls removed for a time) joining?

	Continuous mating	or Controlled mating	
		Bulls in (month)	**Bulls out** (month)
Maiden heifers (1st joining)			
1st lactation females (2nd joining)			
Breeders			

62. Do you have bulls assessed for breeding soundness (BBSE)?

☐Yes
☐No

63. If yes, how often?

☐Before purchase
☐Once every _____ years

64. What bull percentage do you aim to run? _____%

65. What breeds of bulls have you purchased over last three years?

Bull breed	Purchases Number	%	Comment
Bos indicus			
Brahman			
Droughtmaster			
Santa Gertrudis			
Brangus			
Charbray			
Braford			
Other			
British & European			
Angus			
Charolais			
Limousin			
Other			
Composites/Crossbreds			
Belmont Red			
Boran			
Senepol			
Other			

66. Do you use Estimated Breeding Values when selecting bulls?

☐Yes
☐No

a. If yes, what is your level of understanding of EBV traits?

low understanding ☐1 ☐2 ☐3 ☐4 ☐5 high understanding

67. List what you consider the most important EBV traits (up to four) for your business?

- ☐ Gestation length (days)
- ☐ Calving ease (%)
- ☐ Birth Wt (kg)
- ☐ 200 day wt (kg)
- ☐ 400 day wt (kg)
- ☐ 600 day wt (kg)
- ☐ Mature Cow wt (kg)
- ☐ Milk (kg)
- ☐ Scrotal size (cm)
- ☐ Days to calving (days)
- ☐ Carcase wt (kg)
- ☐ Eye muscle area (sq. cm)
- ☐ Rib fat (mm)
- ☐ Rump fat (mm)
- ☐ Retail beef yield (%)
- ☐ Itramuscular fat (%)
- ☐ Flight time (secs)
- ☐ Docility (%)
- ☐ Shear force (trial)
- ☐ Net feed intake (kg/day) trial
- ☐ Breed index ($)

68. Is pregnancy testing normal yearly practice?

☐Yes – for all cows
☐Yes – for dry cows
☐Yes – for cull cows
☐Yes – for heifers
☐No

69. Is foetal age data being recorded and used for management?

☐Yes
☐No

70. List the health treatments used in your herd

Treatment	Weaners in Weaning year	Steers	Replacement Heifers	Breeders	Bulls
Vaccines					
Botulism					
5 in 1					
7 in 1					
Leptospirosis					
Pestivirus					
Tick Fever					
Vibriosis					
3 Day					
Other					
Parasite Control					
Buffalo Fly					
Lice					
Ticks					
Worms					
Other					

71. Do you use individual animal performance data? (Able to identify/record individual animal data)

☐Yes – with management ear tags
☐Yes – with EID ear tag and management tag
☐Yes – with EID ear tag
☐Yes – with Bolus
☐No

72. How often do you handle the following classes of cattle per year? (Questions relates to the number of TIMES cattle were handled, not the NUMBER of cattle handled)

Class of Cattle	Number
Weaners	
Un-mated heifers	
Breeders	
Steers	
Comments:	

73. What were your mustering costs for the last year? Please complete the attached table.

Item		Cost ($)
Helicopter	Hrs @	
Fixed wing	Hrs @	
Wages (row missing from database)	Days/weeks etc @	
Horse costs (feed, shoes, health)		
On station cattle transport eg. weaners		
Fuel - Avgas		
Fuel – vehicles, truck, bikes, buggies, camp		
Repairs – bikes, buggies		
Sundry and Other costs		
Total costs		
Total Cattle Numbers put through yard		

74. Do you feed cattle supplements?

☐ Yes
☐ No

75. What classes of stock do you usually supplement?

	All Stock	Weaners	Breeding heifers	First Lactation Females	Breeders	Steers	Bulls
Wet season supplements							
NA							
Phosphorus lick							
Phosphorus block							
Salt & sulphur lick							
Salt & sulphur block							
COMMENT							
Dry season supplements							
NA							
Protein							
Urea - lick							
Urea - block							
Urea - Liquid supplement							
Urea - Water medicator							
Phosphorus included							
Energy & Protein							
Protein meal							
Fortified molasses							
Grain based rations							
COMMENT							
Bad Years							
NA							
Protein							
Urea - lick							
Urea - block							
Urea - Liquid supplement							
Urea - Water medicator							
Phosphorus included							
Energy & Protein							
Protein meal							
Fortified molasses							
Grain based rations							
COMMENT							

76. What was the cost of supplement/head last year (Total $'s/Total cattle fed)?

Season	Per Head	Annual Cost
Dry Season		
Wet Season		

7.3 List of survey staff

Table 74 - List of internal and external staff/organisations who undertook survey work for the project. (* denotes staff that have since left the department)

DAF Survey Staff	Contract Surveyors
Kate Brown	Burnett Mary Regional Group
Sue Carstens	Russ Tyler
Byrony Daniels	John Bertram
Megan Willis	Brad Wedlock
Lauren Devlan*	Colin Paton
Bernie English	Gerry Roberts
Jim Fletcher	John Chamberlain
Karl McKellar	Felicity Hamlyn-Hill
Tim Moravek	Jenny Reeves
Ken Murphy	Peter Smith
Mick Sullivan	Graeme Elphinstone
Olivia Pisani*	
Joe Rolfe	
Bob Shepherd	
Damien Sullivan	
Lauren Williams	
Kiri Broad	
Ross Dodt	

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