



Heavy metal's, trace elements, pasture and cattle observations from the Upper Hunter mine grazing study

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Explanation of the Hunter mine project

- The Hunter mine grazing study was established to answer the question
“Can rehabilitated mine land sustainably support productive and profitable livestock grazing?”
and address community concerns, through a grazing study on two mine sites.

TWO Sites

- HVO- Singleton
- Rehab & Analogue
- Rehab 30 years ago
- 2 x 20ha paddocks each
- 10 Angus steers each (group 2, 15 on rehab)
- Assess pastures every 6 weeks
- Weigh steers every 12 weeks



TWO Sites

- MAC – Muswellbrook
- Rehab & Analogue
- Rehab 15 years ago
- 3 x 10 ha paddocks each
- 10 Angus steers each
- Assess pastures every 6 weeks
- Weigh steers every 12 weeks



Mt Arthur Coal - Analogue

Nov 2014



Jan 2015



July 2015

Feb 2017



Department of
Primary Industries

Mt Arthur Coal - Rehab

Nov 2014



Jan 2015



Mar 2015



Nov
2016



HVO - Analogue

Nov 2014



Feb 2015

May 2015



Feb 2017



Department of
Primary Industries

HVO - Rehab

Nov 2014



Feb 2015



Feb
2017



Aug 2015



Department of
Primary Industries

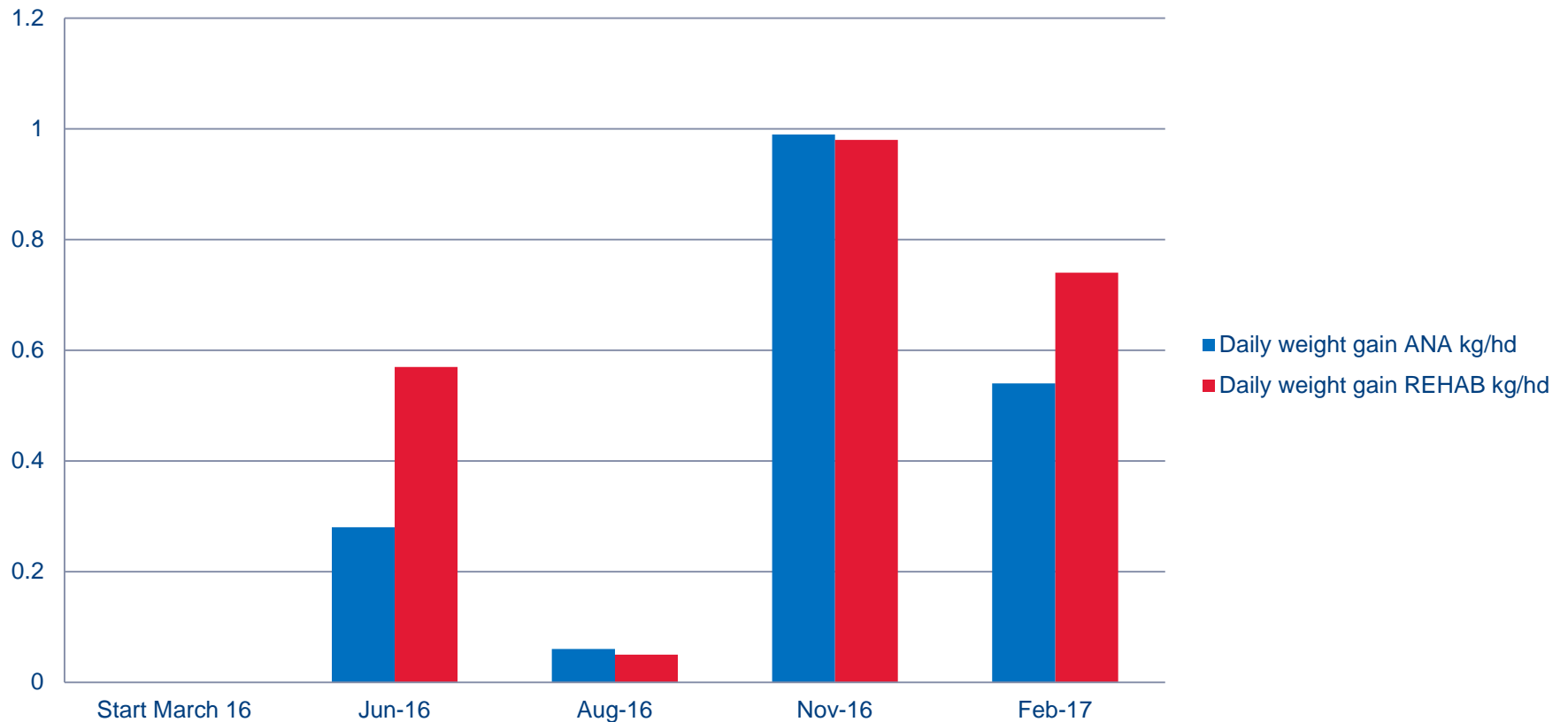
Summary:

Cattle final values Group 1

Site	Treatment	Average Weight	Final	Average P8 fat depth	Average value \$/head
Mt Arthur	Native analogue	537 kg/head		5.3 mm	\$1506
	Rehab	586 kg/head		7.0 mm	\$1822
HVO	Native Analogue	611 kg/head		9.3 mm	\$1560 (estimated)
	Rehab	764 kg/head		23.7 mm	\$2017 (estimated)

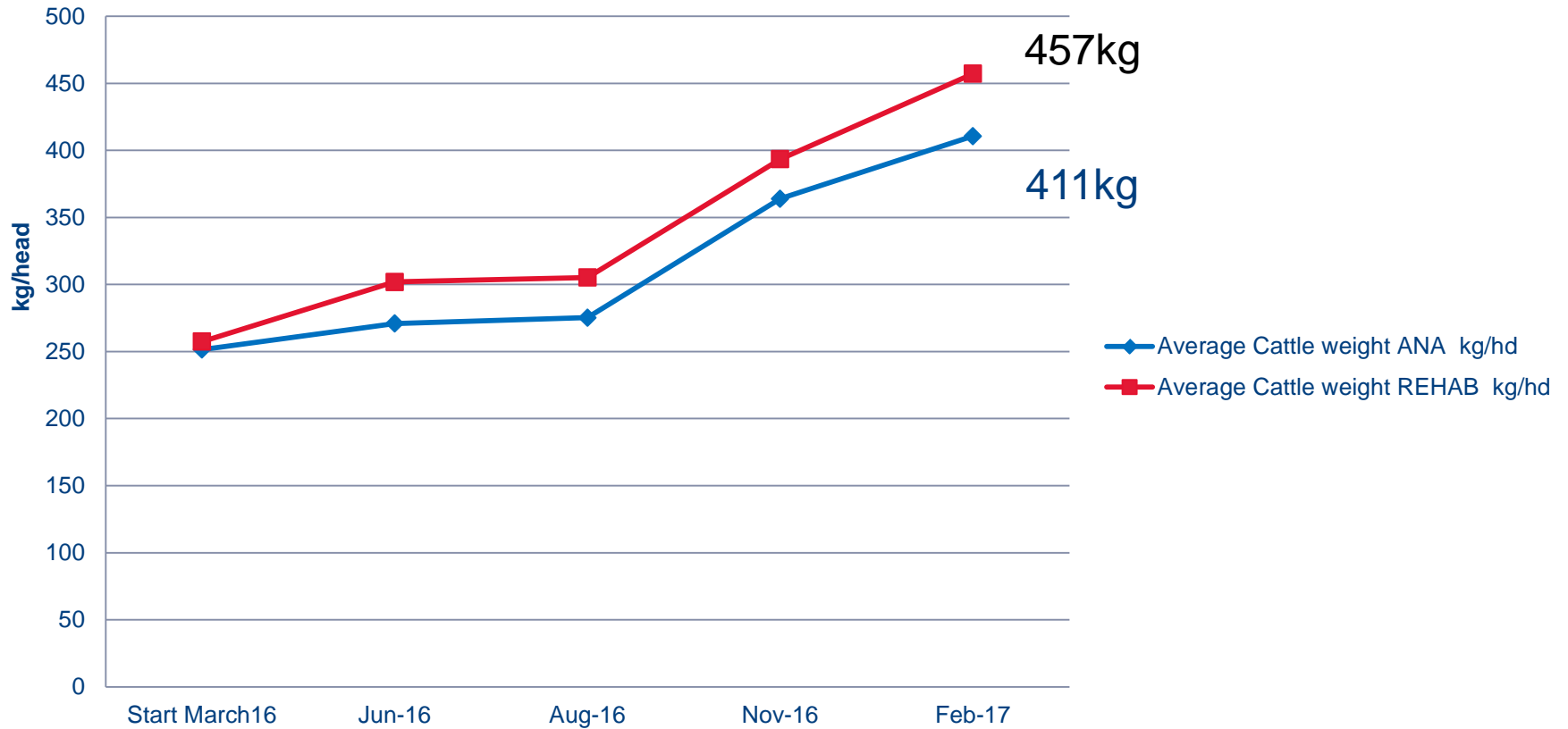
Cattle Weights - BHPB

Mt Arthur (Group 2) Average daily weight gain



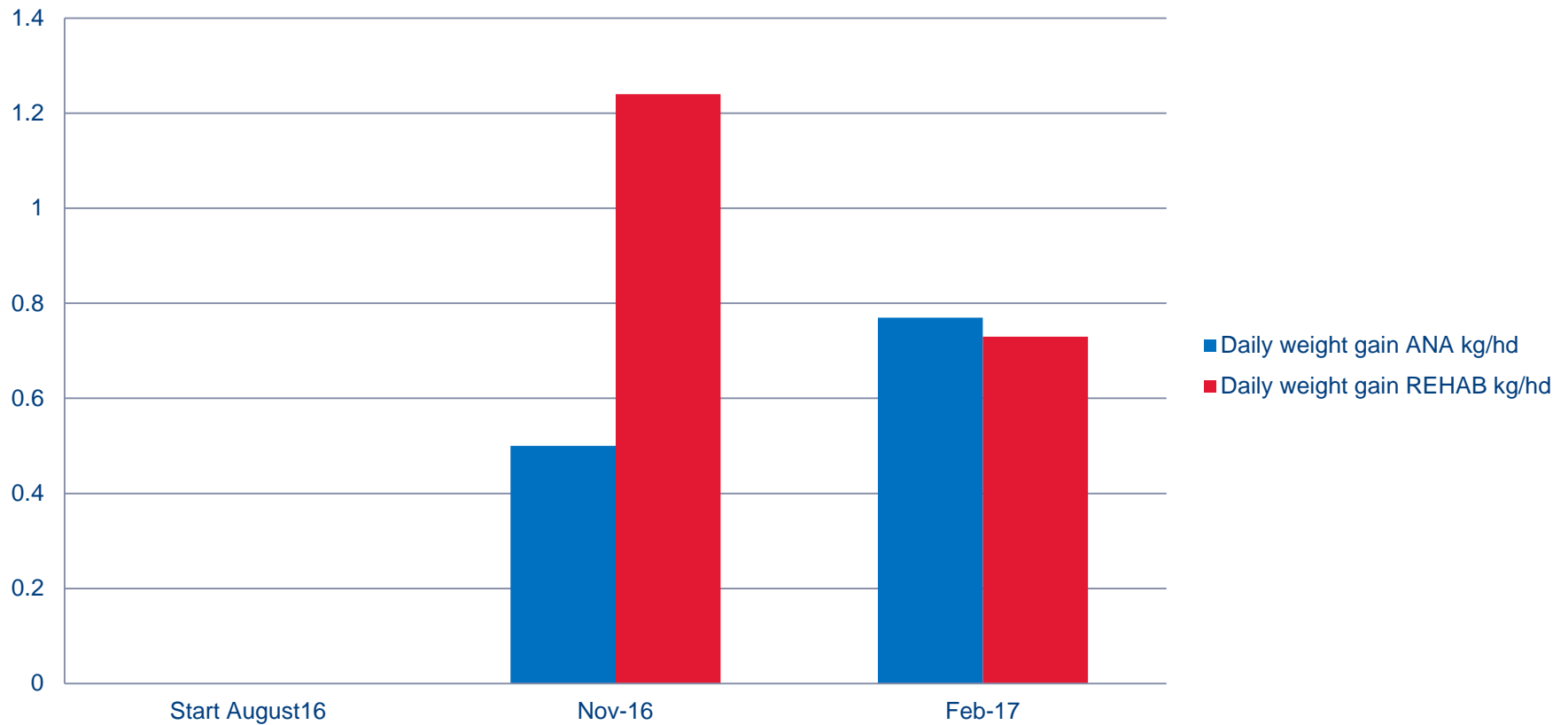
Cattle Weights - BHPB

Mt Arthur (Group 2) Cattle weight



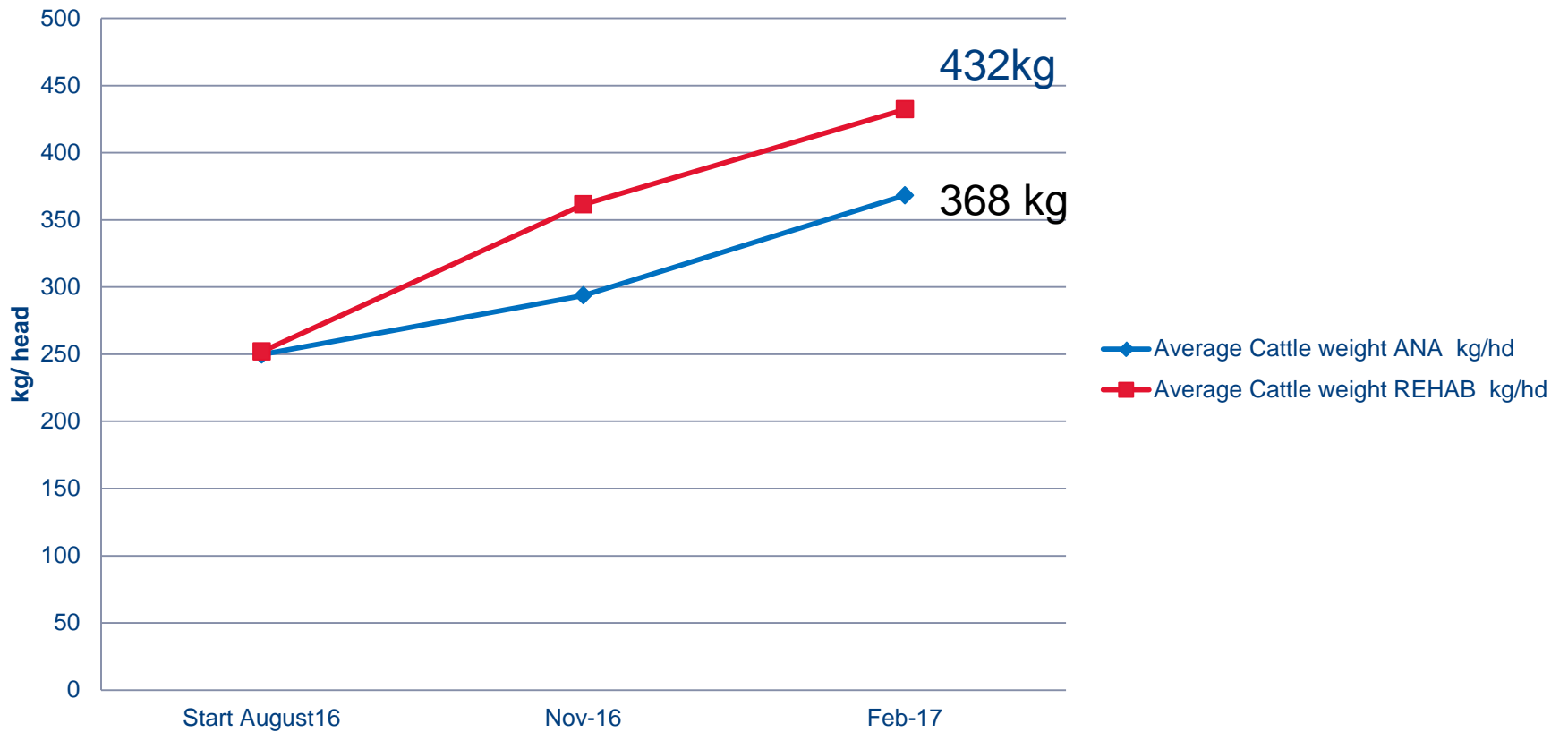
Cattle Weight - HVO

HVO (Group 2) Cattle Average Daily Weight Gain



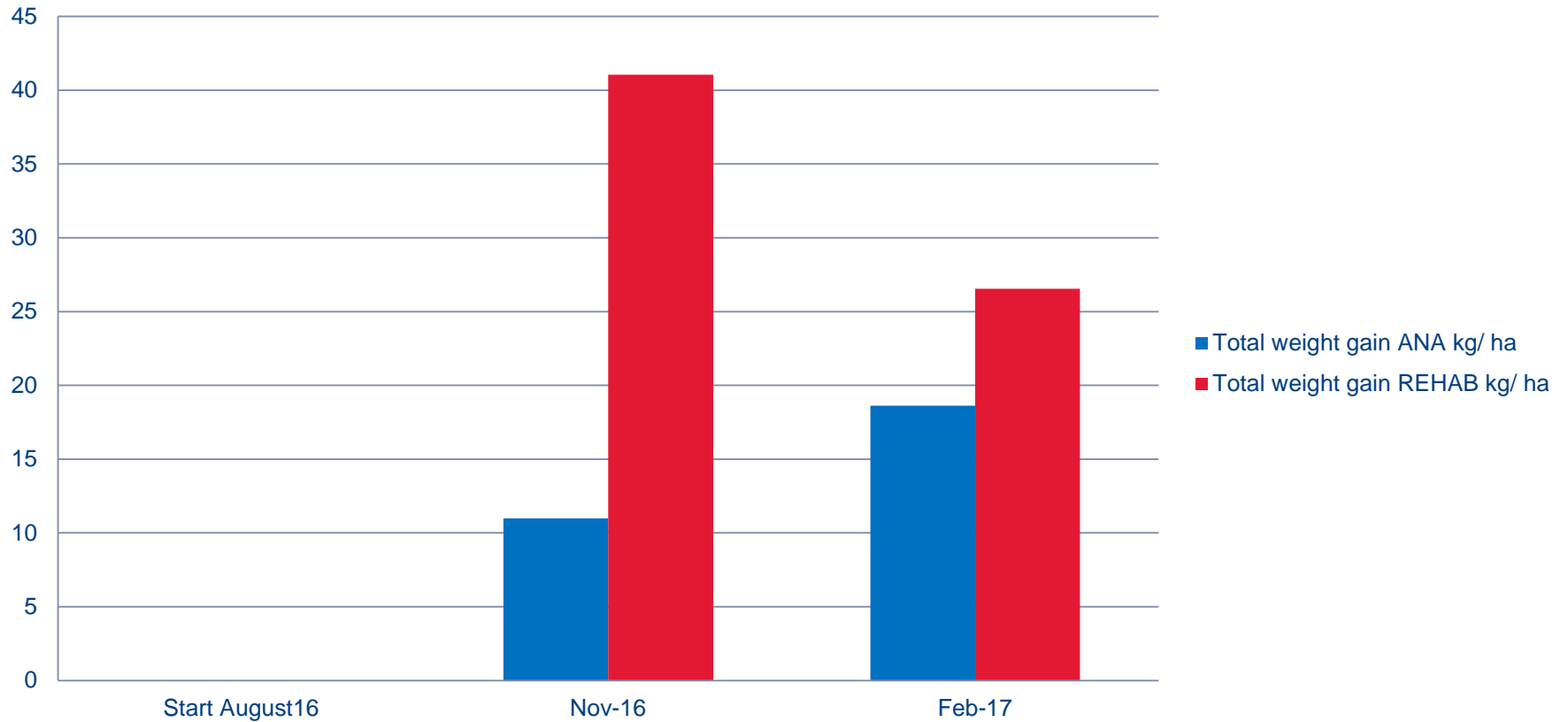
Cattle Weight - HVO

HVO (Group 2) Cattle Weight



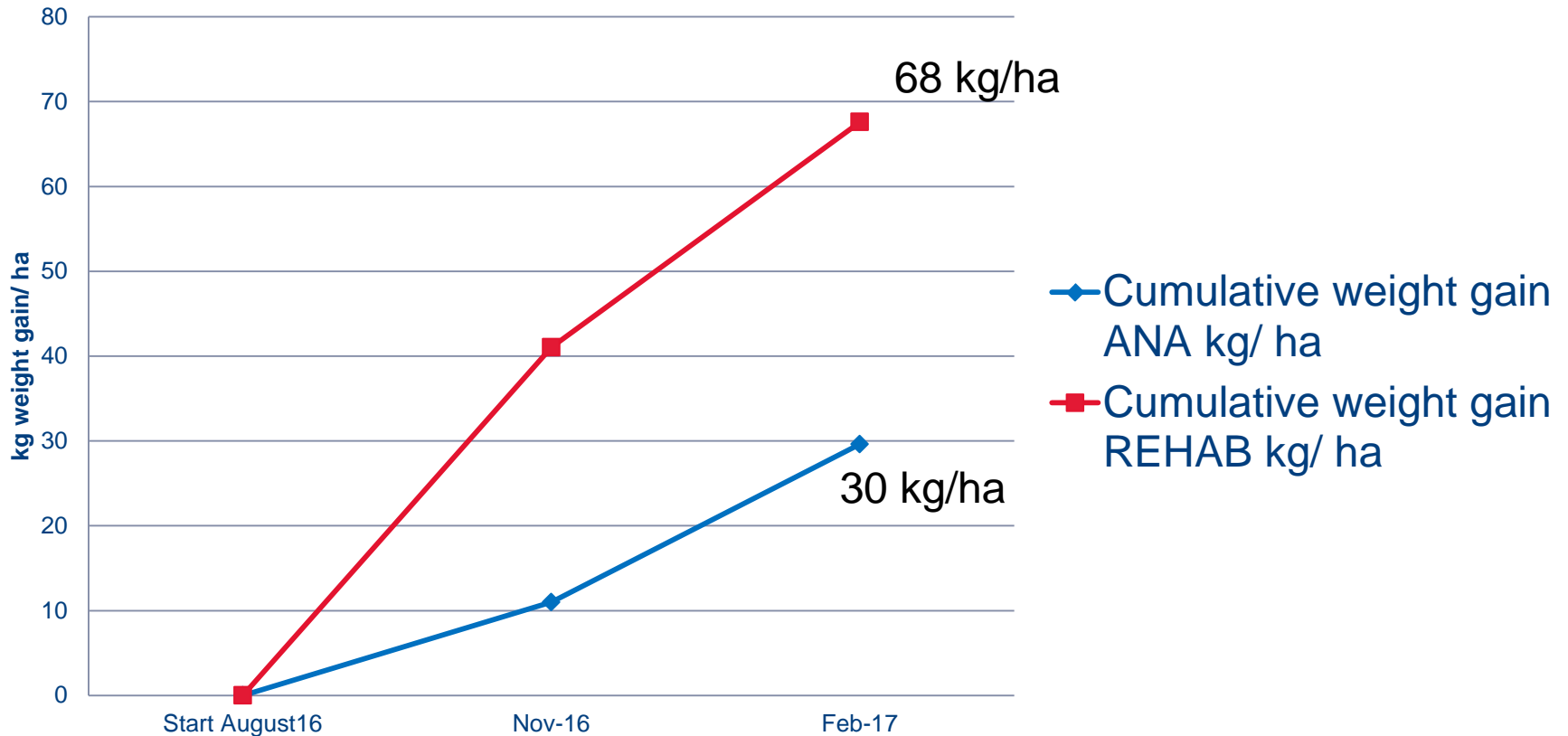
Cattle Weight - HVO

Total weight gain /ha on each block each weighing



Cattle Weight - HVO

Cumulative weight gain /ha on each block

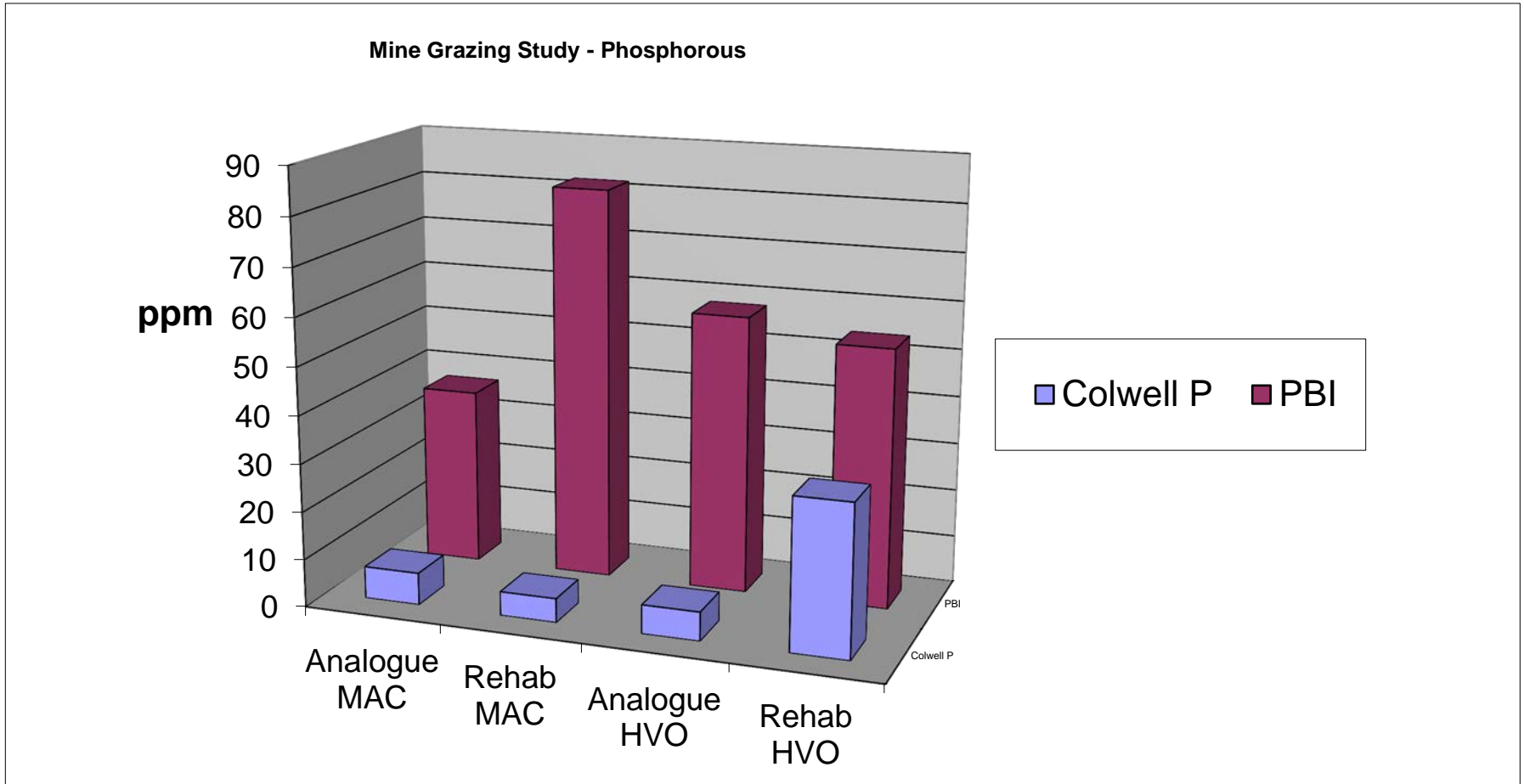


Soil test results

- pH
- EC
- Sulphur
- Potassium
- Carbon

All Similar

Soil Test Results



Target 35+ppm (Colwell)



Heavy metals in soil

Metal mg/kg (ppm)	Max level in soil (EPA Biosolids)	MAC ANA n=3	MAC Rehab n=3	HVO ANA n=2	HVO Rehab n=2
Cadmium	1	0.19	0.2	0.19	0.31
Chromium	100	30	57.3	20	18
Copper	100	11.7	14	9.8	11.5
Lead	150	8.7	9.1	11	13
Manganese	-	463	507	440	515
Nickel	60	23	71.7	11.25	11
Zinc	200	42	44.7	36.5	50

Heavy metals in pasture

- 290 samples analysed
- Arsenic all < 0.4 mg/kg (ppm)
- Cadmium all ≤ 0.2 mg/kg
- Lead all < 2 mg/kg
- Selenium all < 4 mg/kg

Heavy metals in pasture cont.

mg/kg	MAC Min	Rehab Max	MAC Min	ANA Max	HVO Min	Rehab Max	HVO Min	ANA Max
Boron	4.6	11.5	6.9	15.3	4.2	14.0	6.1	15.5
Chromium	0.5	1.8	0.38	1.3	0.65	1.2	0.25	1.3
Copper	3.1	5.5	4.7	6.7	3.2	6.2	4.2	7.1
Manganese	29	49	48	89	18	74	66	205
Molybdenum	1.7	2.7	<1	<1	<1	1.1	<1	1.2
Nickel	1.2	8.7	<0.7	3.2	<0.7	1.1	<1	6.2
Zinc	19	61	28	56	14	145	37	124

Heavy metals in cattle (blood)

- Blood samples were taken by LLS vet from five animals in each group on entry and exit to the study sites (on site for 18 months).
- Samples tested for Selenium, Copper, Zinc, Lead plus some related tests.
- Results were within normal range (not high or low) except for selenium which varied at each site BUT no difference between rehab and analogue at either site.

A few species dominate but much more diversity than expected !

- HVO

Analogue 122 species

Rehab 87 species

- Mt Arthur

Analogue 160 species

Rehab 79 species



Major pasture species

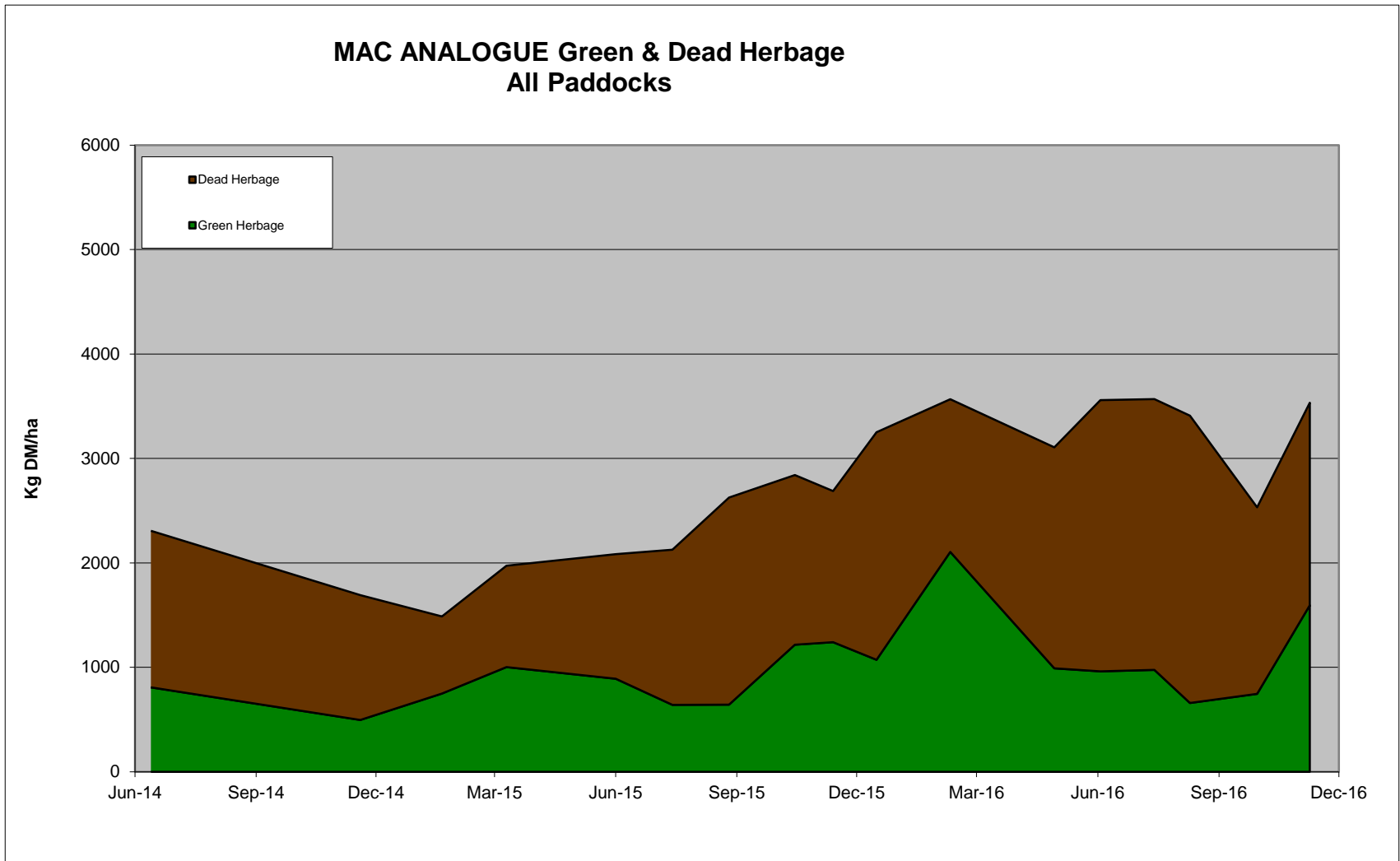
Rehab

- Rhodes grass
- Panic

Analogue (Native)

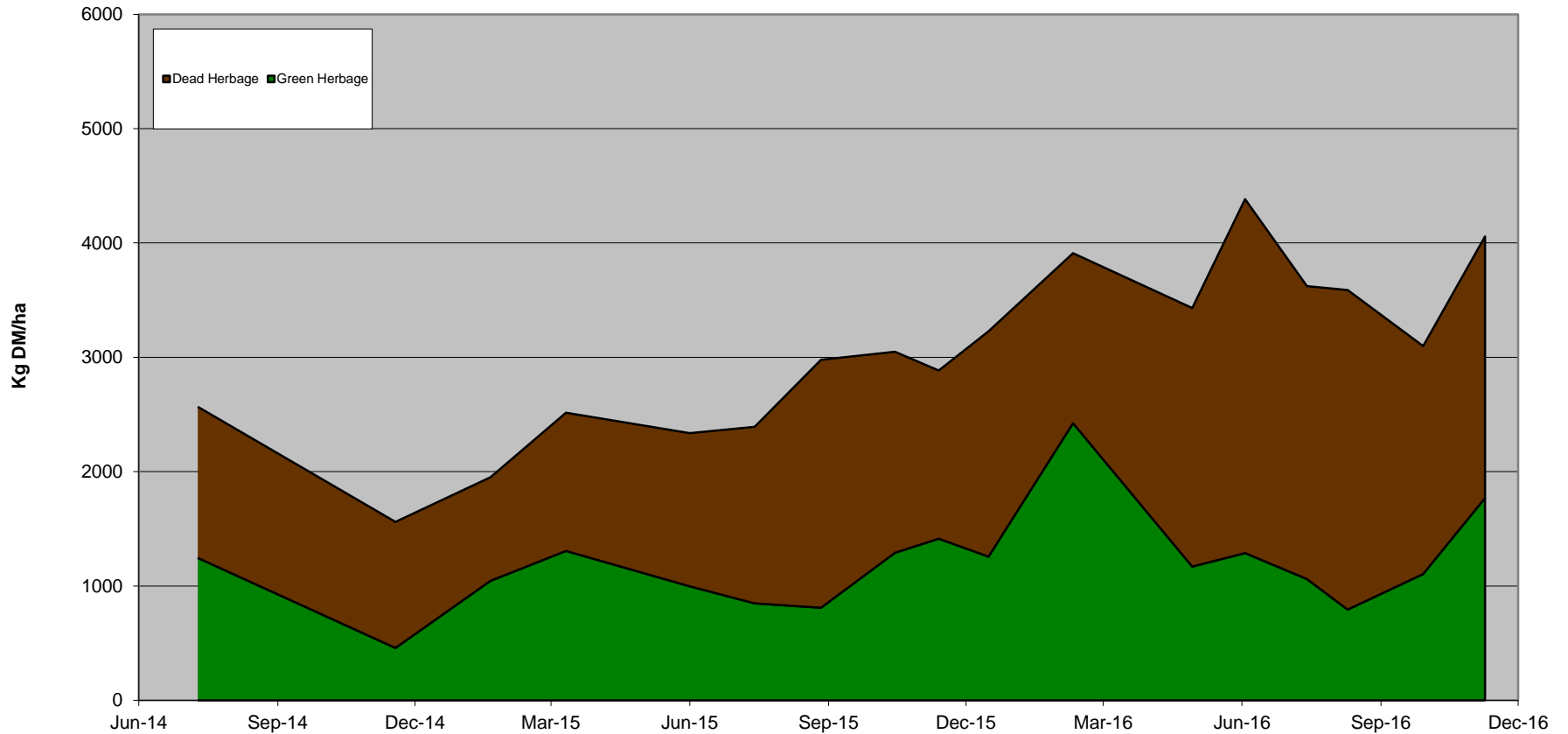
- Red grass / Qld Blue Grass
- Wiregrass
- Sporobolus (Paramatta Grass)
- Other perennial C4 grasses

Mt Arthur Herbage Mass



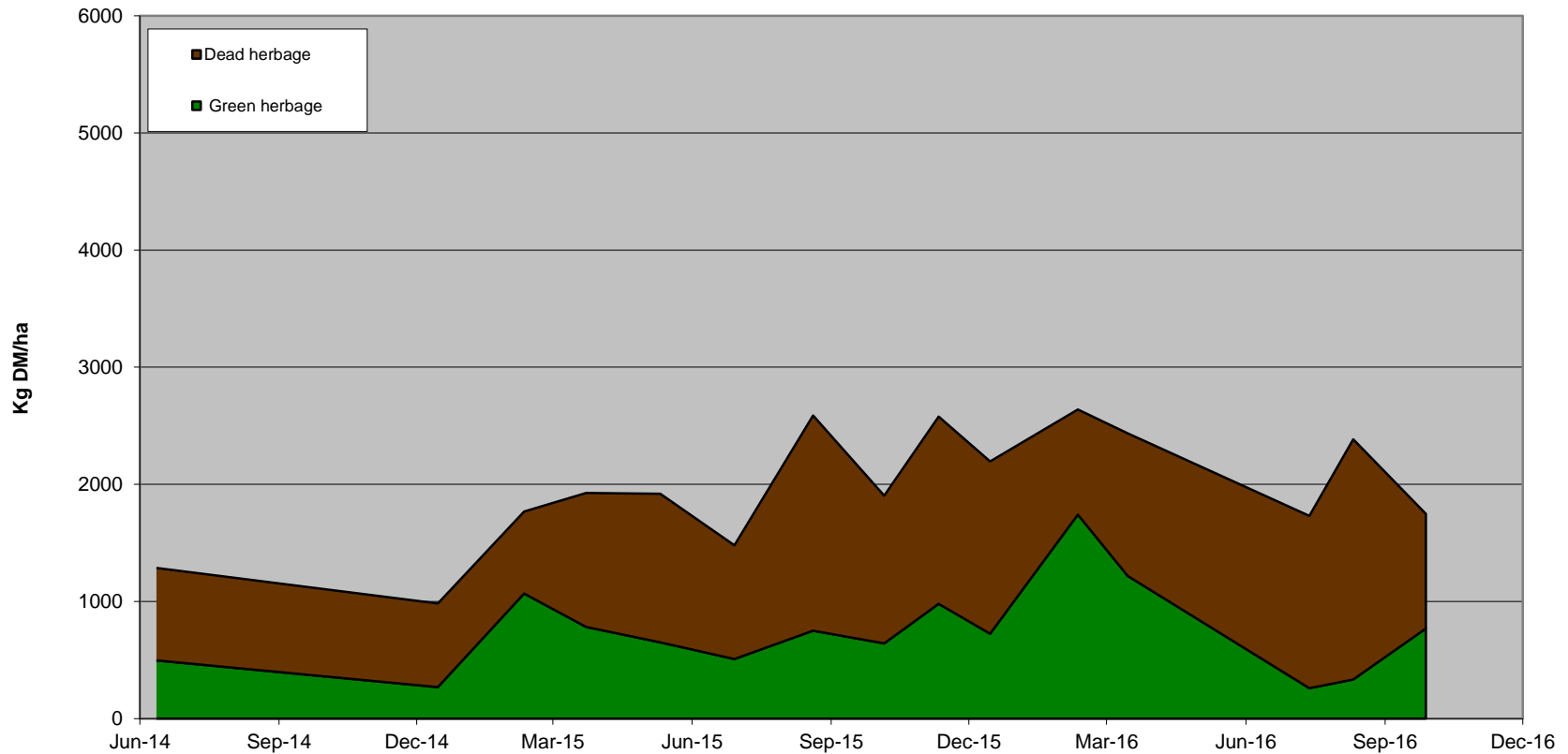
Mt Arthur Herbage Mass

MAC REHABILITATION Green & Dead Herbage
All Paddocks



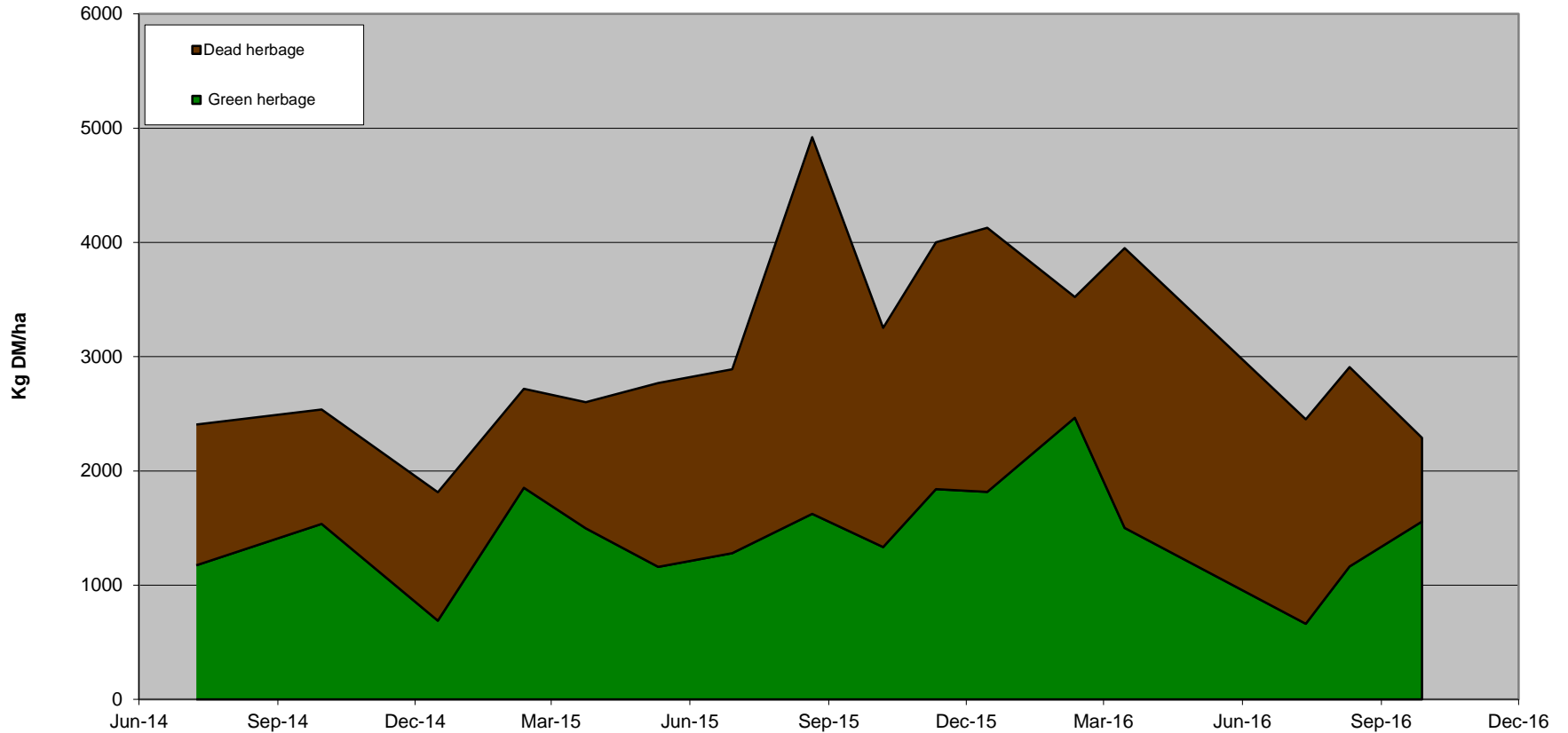
HVO Herbage Mass

HVO ANALOGUE Green & Dead Herbage
Paddock 1



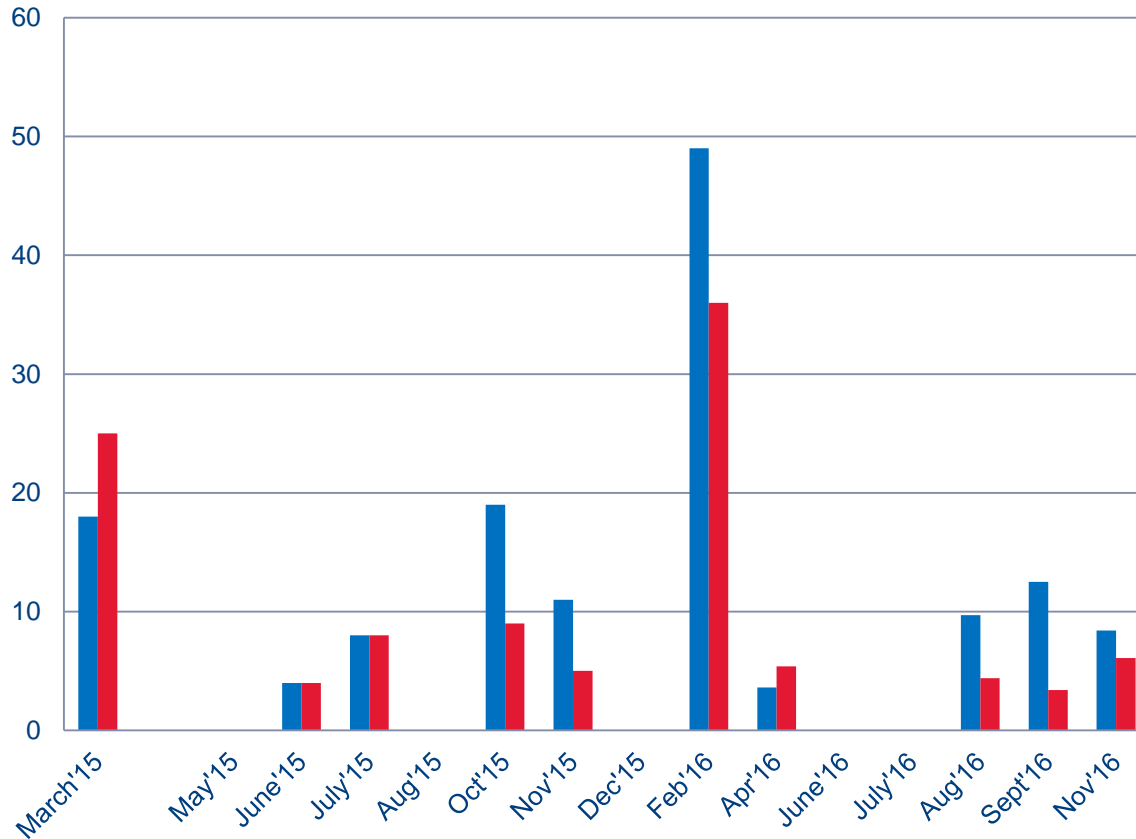
HVO Herbage Mass

HVO REHABILITATION Green & Dead Herbage
Paddock 1



Pasture Growth – daily

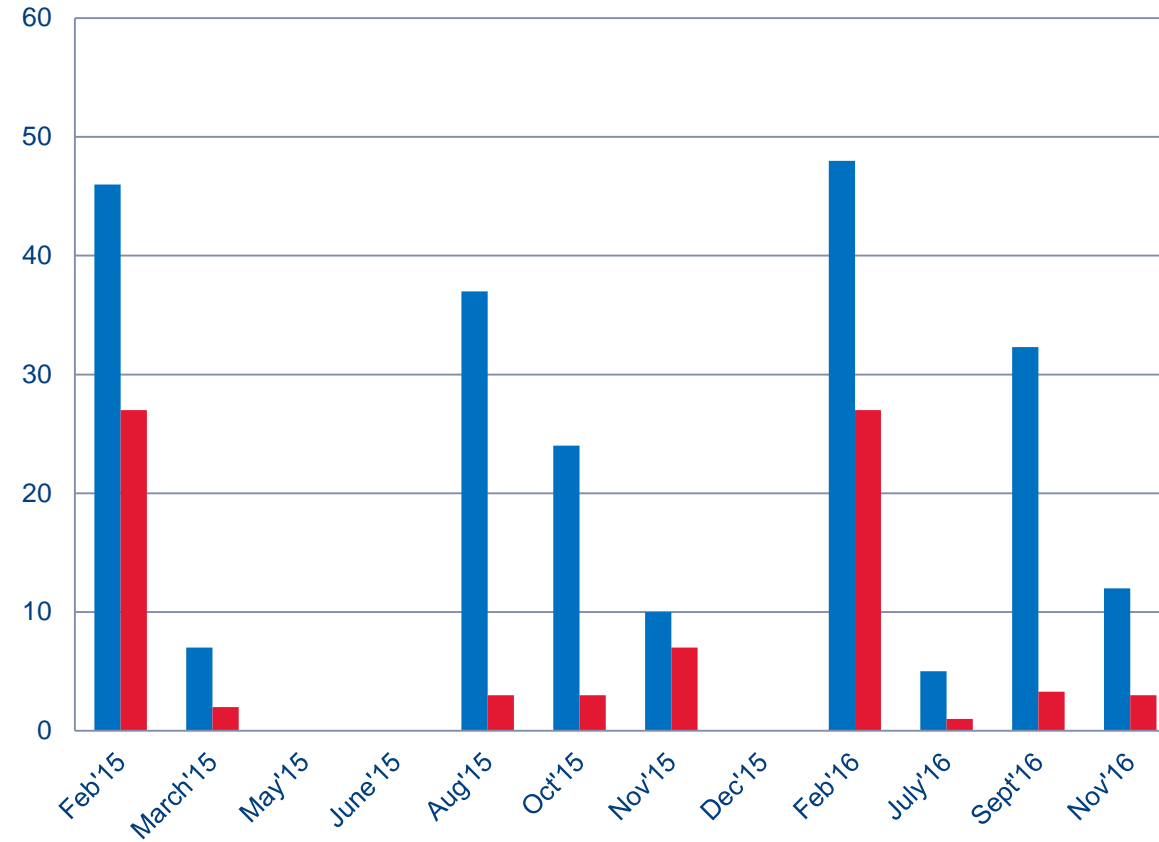
Mt Arthur Pasture Growth (cages)



- kgDM/ha/day Rehab
- kgDM/ha/day Native ANA

Pasture Growth – daily

HVO Pasture Growth (cages)

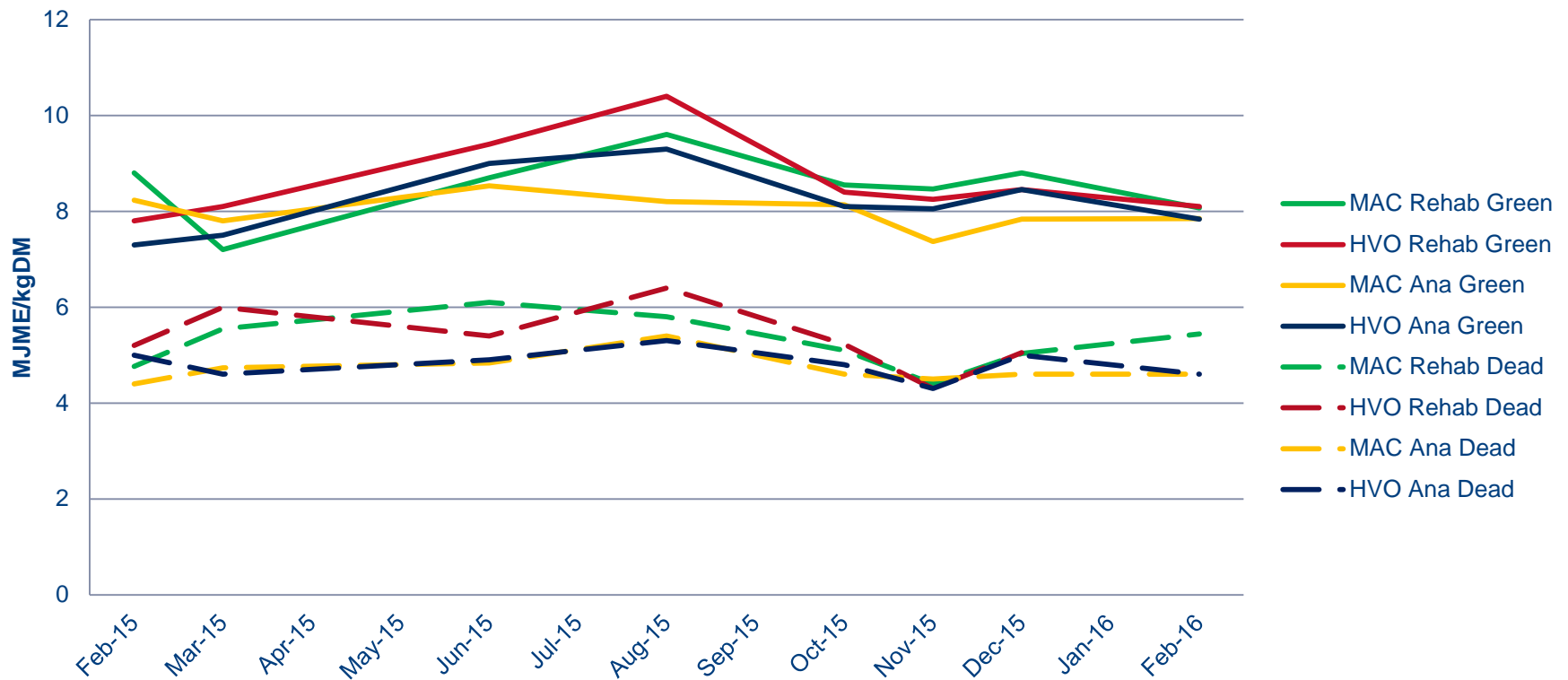


■ kgDM/ha/day
Rehab

■ kgDM/ha/day
Native ANA

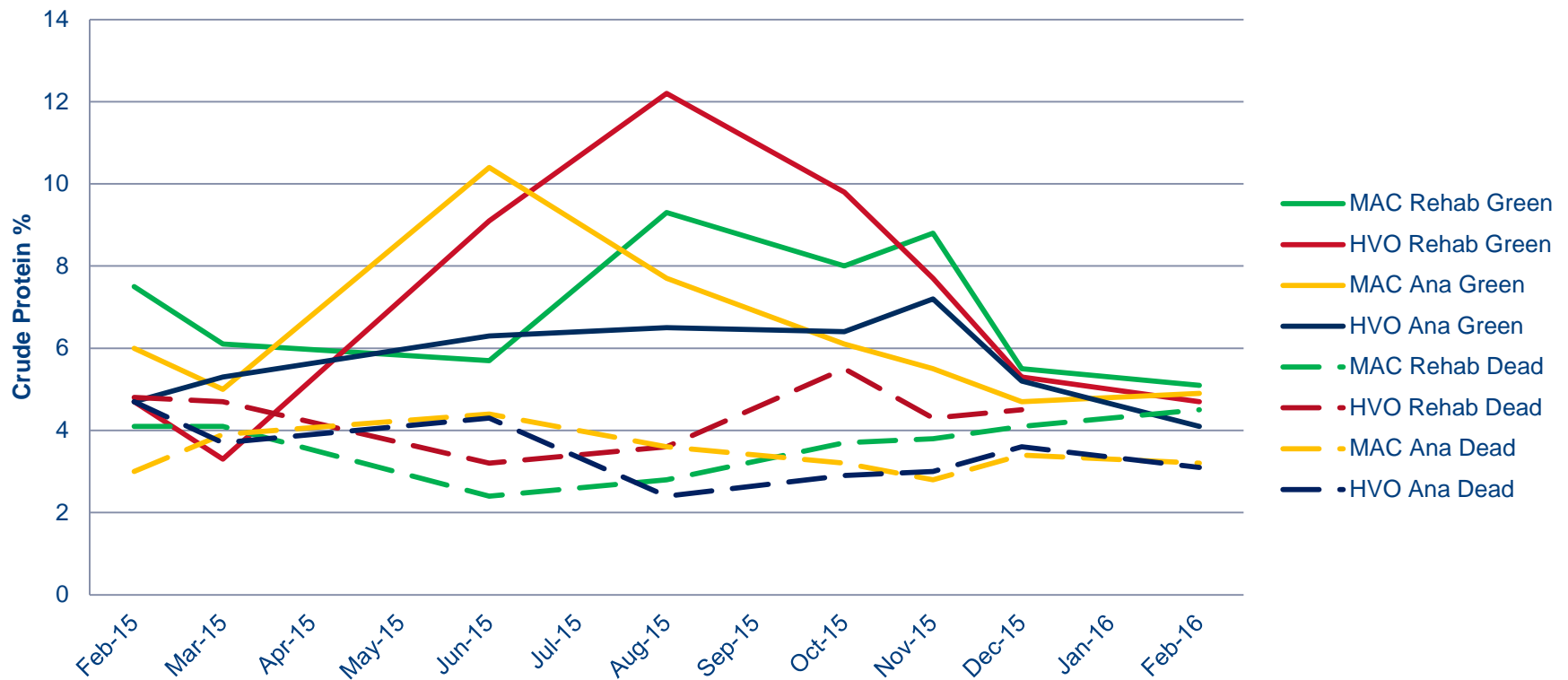
Feed Quality Analysis – Metabolisable Energy (ME)

Hunter mine grazing study Metabolisable Energy (ME)



Feed Quality Analysis – Crude Protein (CP)

Hunter mine grazing trial Crude Protein



What could be done to increase beef production from these pastures ?

- Grazing management and stocking rate
- More legumes
- New grass species and varieties
- Fertiliser !

Project Partners

- NSW DPI
- ACARP (Australian Coal Association Research Program)
- NSW Resources and Energy
- HVO (Rio Tinto) & MAC (BHPB)
- Local Farmers
- Hunter Local Land Services (Vet)
- Support from UHMD

