METQ15

Described by C. Gill		Date 16/10/2019		Site Type 20 m x 5 m Quadrat		
Location	Whiteman Park					
MGA zone	50	Easting: 400804		Northing: 6476093		
Habitat	Bennett Brook banks					
Soil	Black peaty sand					
Vegetation description	*Melaleuca rhaphiophylla* and *Eucalyptus rudis* subsp. *rudis* Open to Closed Forest over a mixed exotic Closed Grassland / Forbland / Sedgeland					
Vegetation condition	Degraded					
Fire age	> 10 years					

Taxon	Cover	Height
Acacia saligna	10	1000
Banksia littoralis	1	600
Centella asiatica	5	20
Conyza sumatrensis	+	50
Crassula natans var. *minus*	+	1
Eucalyptus rudis subsp. *rudis*	20	1500
Isolepis prolifera	10	30
Juncus microcephalus	+	100
Melaleuca lateritia	6	200
Melaleuca rhaphiophylla	50	1000
Paspalum distichum	10	20
Polygonum sp.	4	50
Rorippa nasturtium-aquaticum	30	50
Rumex sp.	1	50
Sonchus oleraceus	1	20
Trihaloragis hexandra subsp. *integrifolia*	+	20

METQ16						
Described by C. Tauss		Date 16/10/2019		Site Type 20 m x 5 m Quadrat		
Location	Whiteman Park					
MGA zone	50	Easting: 400921		Northing: 6475300		
Habitat	Bennett Brook banks					
Soil	Black peaty sand					
Vegetation description	*Melaleuca rhaphiophylla* and *Eucalyptus rudis* subsp. *rudis* Open Forest over a mixed exotic Closed Grassland / Forbland / Sedgeland					
Vegetation condition	Degraded					
Fire age	> 10 years					

Taxon	Cover	Height
Centella asiatica	10	10
Crassula natans var. *minus*	2	1
Cycnogeton lineare	1	40
Cyperus tenellus	+	5
Eucalyptus rudis subsp. *rudis*	10	1500
Holcus lanatus	30	20
Hypochaeris glabra	+	1
Isolepis prolifera	20	40
Juncus microcephalus	4	100
Medicago polymorpha	+	5
Melaleuca rhaphiophylla	40	1200
Polygonum sp.	2	20
Rorippa nasturtium-aquaticum	10	50
Rubus sp.	+	10
Rumex sp.	1	60
Solanum nigrum	+	40
Sonchus oleraceus	+	20

METQ17						
Described by C. Tauss		Date 16/10/2019		Site Type 10 m x 10 m Quadrat		
Location	Whiteman Park					
MGA zone	50	Easting: 401487		Northing: 6478656		
Habitat	Undulating plain					
Soil	Grey quartz sand					
Vegetation description	*Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* Open Forest over *Xanthorrhoea preissii* Open Shrubland					
Vegetation condition	Good to Degraded					
Fire age	> 10 years					

Taxon	Cover	Height
Arctotheca calendula	+	5
Briza maxima	2	20
Caladenia flava	+	4
Corymbia calophylla	30	1500
Crassula colorata var. *acuminata*	+	3
Drosera erythrorhiza	+	1
Ehrharta longiflora	2	10
Eucalyptus marginata subsp. *marginata*	10	5
Hibbertia racemosa	1	50
Hypochaeris glabra	3	10
Lomandra hermaphrodita	+	20
Moraea flaccida	+	20
Petrorhagia dubia	+	30
Podotheca gnaphalioides	+	10
Poranthera microphylla	+	4
Pterostylis vittata	+	15
Romulea rosea	+	10
Trachymene pilosa	+	3
Wahlenbergia capensis	+	2
Xanthorrhoea preissii	18	175

METQ18						
Described by C. Tauss		Date 16/10/2019		Site Type 10 m x 10 m Quadrat		
Location	Whiteman Park					
MGA zone	50	Easting: 401196		Northing: 6480443		
Habitat	Undulating plain					
Soil	Grey quartz sand					
Vegetation description	*Eucalyptus todtiana, Banksia menziesii, B. attenuata* and *B. ilicifolia* Low Woodland over *Calytrix flavescens, Patersonia occidentalis* var. *occidentalis, C angulata, Eremaea pauciflora, Scholtzia involucrata* and *Mesomelaena pseudostygia* Low Open Shrubland.					
Vegetation condition	Very Good					
Fire age	> 10 years					

Taxon	Cover	Height
Acacia pulchella var. *glaberrima*	1	40
Anigozanthos humilis subsp. *humilis*	+	10
Banksia menziesii	18	400
Briza maxima	1	20
Caladenia flava	+	5
Calandrinia corrigioloides	+	2
Calytrix angulata	1	30
Calytrix flavescens	7	80
Desmocladus flexuosus	1	10
Ehrharta calycina	+	20
Ehrharta longiflora	+	20
Eremaea pauciflora	5	80
Hibbertia sericosepala	+	30
Hibbertia striata	1	40
Hyalosperma cotula	+	10
Hybanthus calycinus	1	40
Hypochaeris glabra	+	2
Levenhookia stipitata	+	5
Lomandra hermaphrodita	+	20
Lomandra suaveolens	+	30
Mesomelaena pseudostygia	1	30
Patersonia occidentalis var. *occidentalis*	6	50
Pentameris airoides subsp. *airoides*	1	20
Petrophile linearis	+	30
Podotheca chrysantha	1	20
Stylidium tenue subsp. *majusculum*	+	40
Synaphea spinulosa subsp. *spinulosa*	1	40
Trachymene pilosa	1	5
Ursinia anthemoides	2	20

METQ19

Described by C. Tauss		Date 17/10/2019		Site Type 10 m x 10 m Quadrat		
Location	Whiteman Park					
MGA zone	50	Easting: 400951		Northing: 6480979		
Habitat	Undulating plain - gentle slope					
Soil	Grey quartz sand					
Vegetation description	*Banksia ilicifolia* and *B. menziesii* Low Woodland with emergent *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over *Melaleuca seriata, Xanthorrhoea brunonis* and *Hypocalymma angustifolium* subsp. Swan Coastal Plain (G.J. Keighery 16777) Mid Open Shrubland over *Hibbertia racemosa, Calytrix fraseri* and *Patersonia occidentalis* var. *occidentalis* Low Sparse Shrubland over a mixed Sparse Forbland.					
Vegetation condition	Very Good					
Fire age	> 20 years					

Taxon	Cover	Height
? Stylidium sp.	+	5
Adenanthos obovatus	1	100
Banksia ilicifolia	22	1000
Banksia menziesii	7	500
Banksia sp.	+	15
Briza maxima	1	20
Burchardia congesta	+	30
Caladenia flava	+	5
Calytrix fraseri	1	40
Carpobrotus edulis	+	2
Cassytha racemosa	1	30
Disa bracteata	+	5
Drosera erythrorhiza	+	30
Eucalyptus marginata subsp. *marginata*	12	1000
Gastrolobium capitatum	1	20
Hibbertia racemosa	1	30
Hyalosperma cotula	+	5

Taxon	Cover	Height
Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)	6	100
Hypochaeris glabra	1	2
Lomandra hermaphrodita	+	20
Lomandra suaveolens	+	10
Lyginia imberbis	1	20
Melaleuca seriata	17	180
Nuytsia floribunda	1	1
Patersonia occidentalis var. *occidentalis*	2	40
Petrophile linearis	1	30
Philotheca spicata	1	50
Podotheca gnaphalioides	1	10
Schoenus sublateralis	1	10
Scholtzia involucrata	1	30
Stylidium neurophyllum	+	30
Stylidium piliferum	+	2
Trachymene pilosa	2	10
Tricoryne tenella	1	10
Ursinia anthemoides	1	20
Xanthorrhoea brunonis	5	100
Xanthorrhoea preissii	1	100

METQ22						
Described by C. Gill		Date 15/10/2019		Site Type 20 m x 5 m Quadrat		
Location	Whiteman Park					
MGA zone	50	Easting: 398726		Northing: 6476396		
Habitat	Inundated peat in creek artesian seepage, waterlogged to surface					
Soil	Black peat					
Vegetation description	*Corymbia calophylla* and *Melaleuca preissiana* Closed Forest over *Taxandria linearifolia* Tall Shrubland over *Lepidosperma longitudinale, Cyathochaeta teretifolia* (P3), *Patersonia occidentalis* var. *angustifolia* and *Tetraria* sp. Chandala (G.J. Keighery 17055) (P2) Closed Sedgeland.					
Vegetation condition	Excellent					
Fire age	> 10 years					

Taxon	Cover	Height
Acacia longifolia subsp. *sophorae*	+	40
Acacia saligna	+	300
Aotus gracillima	1	90
Astartea scoparia	+	200
Baumea juncea	+	60
Briza minor	+	20
Caladenia latifolia	+	30
Carpobrotus edulis	5	15
Cassytha racemosa	1	cr
Conyza sumatrensis	+	30
Corymbia calophylla	50	1000
Cyathochaeta teretifolia	35	120
Gastrolobium ebracteolatum	2	150
Homalosciadium homalocarpum	+	4
Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)	+	50
Hypochaeris glabra	+	10
Kennedia prostrata	+	cr
Lepidosperma longitudinale	35	130
Lobelia anceps	+	30
Melaleuca preissiana	35	1000
Microtis media subsp. *media*	+	20
Patersonia occidentalis var. *angustifolia*	3	80
Solanum nigrum	+	40
Taxandria linearifolia	60	400
Thysanotus multiflorus	+	50
Trihaloragis hexandra subsp. *integrifolia*	+	20
Vulpia bromoides	+	15

METQ23

Described by C. Tauss		Date 15/10/2019		Site Type 10 m x 10 m Quadrat		
Location	Whiteman Park					
MGA zone	50	Easting: 399852		Northing: 6476432		
Habitat	Undulating plain					
Soil	Grey quartz sand					
Vegetation description	*Eucalyptus marginata* subsp. *marginata, Banksia menziesii, B. ilicifolia, B. attenuata* Low Open Forest over *Eremaea pauciflora, Hibbertia hypericoides, Scholtzia involucrata* and *Patersonia occidentalis* var. *occidentalis* Low Open Shrubland over *Dasypogon bromeliifolius* and *Desmocladus flexuosus* Open Forbland / Rushland					
Vegetation condition	Excellent to Very Good					
Fire age	> 20 years					

Taxon	Cover	Height
Astartea scoparia	+	5
Banksia attenuata	1	400
Banksia ilicifolia	4	800
Banksia menziesii	15	700
Briza maxima	+	10
Burchardia congesta	+	20
Caladenia flava	+	10
Dampiera linearis	+	10
Dasypogon bromeliifolius	18	30
Desmocladus flexuosus	10	10
Disa bracteata	1	10
Ehrharta calycina	+	20
Eremaea pauciflora	4	50
Eucalyptus marginata subsp. *marginata*	35	1000
Gompholobium tomentosum	+	20
Hibbertia hypericoides	1	30
Hibbertia subvaginata	+	20

Taxon	Cover	Height
Jacksonia floribunda	1	30
Lagenophora huegelii	1	20
Leucopogon conostephioides	1	10
Lomandra hermaphrodita	+	20
Lyginia imberbis	+	10
Patersonia occidentalis var. *occidentalis*	8	60
Petrophile linearis	1	10
Pterostylis sp.	+	2
Schoenus curvifolius	2	40
Scholtzia involucrata	2	40
Stylidium repens	+	5
Thysanotus sparteus	1	50
Thysanotus thyrsoideus	1	10
Trachymene pilosa	+	1
Ursinia anthemoides	1	20

METQ24

Described by C. Tauss		Date 15/10/2019		Site Type 10 m x 10 m Quadrat		
Location	Whiteman Park					
MGA zone	50	Easting: 399879		Northing: 6476500		
Habitat	Channel					
Soil	Black peaty sand - sandy peat					
Vegetation description	*Melaleuca preissiana* Open Forest over *Taxandria linearifolia* and *Astartea scoparia* Tall Shrubland over *Lepidosperma longitudinale* and *Leptocarpus scariosus* Sparse Sedgeland.					
Vegetation condition	Excellent					
Fire age	> 15 years					

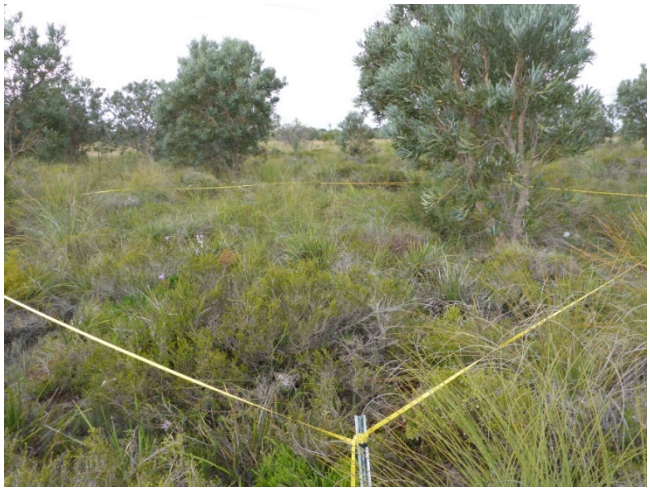
Taxon	Cover	Height
Astartea scoparia	4	200
Baumea acuta	+	10
Boronia crenulata subsp. *viminea*	1	100
Briza maxima	+	30
Caladenia latifolia	+	10
Cassytha racemosa	+	cr
Corymbia calophylla	+	10
Dielsia stenostachya	+	10
Lepidosperma longitudinale	4	100
Lepidosperma striatum	1	50
Leptocarpus scariosus	6	120
Melaleuca preissiana	60	1500
Microlaena stipoides	+	10
Patersonia occidentalis var. *angustifolia*	1	50
Schoenus efoliatus	1	40
Taxandria linearifolia	30	300
Thelymitra crinita	+	40
Thysanotus multiflorus	+	40
Trachymene pilosa	+	2
Trihaloragis hexandra subsp. *integrifolia*	1	40

PTAQ08

Described by B. Morgan		Date 26/10/2017		Site Type 10 m x 10 m Quadrat		
Location	Hepburn Ave, Ballajura					
MGA zone	50	Latitude: -31.85282		Longitude: 115.91972		
Habitat	Crest of low dune					
Soil	Pale grey sand					
Vegetation description	*Banksia 29ttenuate* and *B. menziesii* Low Woodland with scattered *Eucalyptus todtiana* over *Allocasuarina humilis* Shrubland over *Hibbertia hypericoides Astroloma xerophyllum* and *Conostephium pendulum* Low Shrubland over *Alexgeorgea nitens* Very Open Sedgeland					
Vegetation condition	Very Good					
Fire age	> 10 years					
Notes	Appears to have been grazed in the past; surrounds cleared; previous part clearing of Banksias; low disturbance by non-invasive weeds					

Taxon	Cover	Height
Acacia pulchella var. *goadbyi*	+	30
Alexgeorgea nitens	4	15
Allocasuarina humilis	15	150
Amphipogon turbinatus	+	30
Arnocrinum preissii	+	50
Astroloma xerophyllum	5	50
Austrostipa compressa	+	30
Austrostipa semibarbata	+	80
Banksia attenuata	15	400
Banksia menziesii	11	400
Bossiaea eriocarpa	+	25
Briza maxima	+	30
Burchardia congesta	+	40
Calectasia narragara	+	30
Calytrix flavescens	+	20
Cassytha pomiformis	+	cr
Centrolepis drummondiana	+	3
Conostephium pendulum	2	45
Conostylis aculeata subsp. *cygnorum*	+	40
Dampiera linearis	+	20

Taxon	Cover	Height
Daviesia divaricate	+	150
Daviesia triflora	1	45
Desmocladus flexuosus	+	20
Drosera menziesii subsp. *penicillaris*	+	45
Ehrharta calycina	+	60
Eremaea pauciflora var. *pauciflora*	+	40
Gastrolobium capitatum	+	30
Gastrolobium ebracteolatum	+	60
Gladiolus caryophyllaceus	+	45
Gompholobium tomentosum	+	60
Haemodorum spicatum	+	45
Heliophila pusilla	+	15
Hibbertia huegelii	+	30
Hibbertia hypericoides	14	40
Hibbertia spicata	+	10
Hibbertia subvaginata	+	40
Hovea trisperma	+	40
Hypochaeris glabra	+	1
Jacksonia floribunda	+	110
Laxmannia ramosa subsp. *ramosa*	+	10
Laxmannia squarrosa	+	15
Lepidosperma calcicola	+	50
Leucopogon conostephioides	+	70
Levenhookia stipitata	+	30
Lomandra caespitosa	+	30
Lomandra hermaphrodita	+	25
Lomandra preissii	+	35
Lomandra sericea	+	35
Lyginia barbata	+	40
Lyginia imberbis	+	50
Mesomelaena pseudostygia	1-2	45
Patersonia occidentalis	1	50
Pentameris airoides subsp. *airoides*	+	20
Petrophile linearis	+	45
Philotheca spicata	+	30
Phyllangium paradoxum	+	5
Podotheca gnaphalioides	+	12
Scaevola repens	+	15
Schoenus clandestinus	+	3
Schoenus curvifolius	+	3
Scholtzia involucrata	+	40
Stirlingia latifolia	+	150
Stylidium repens	+	15
Synaphea spinulosa	+	35
Trachymene pilosa	+	10
Ursinia anthemoides	+	20
Wahlenbergia capensis	+	25



PTAQ09

Described by C. Tauss		Date 26/10/2017		Site Type 10 m x 10 m Quadrat		
Location	Hepburn Ave, Ballajura					
MGA zone	50	Latitude: -31.84978		Longitude: 115.91809		
Habitat	Low slopes of dune and flat					
Soil	Grey quartz sand					
Vegetation description	*Banksia menziesii* Low Woodland over *Xanthorrhoea brunonis, Scholtzia 31nvolucrate* and *Eremaea pauciflora* Open Low Heath over *Alexgeorgea nitens, Lyginia barbata* and *Patersonia occidentalis* Open Herbland					
Vegetation condition	Very Good to Excellent					
Fire age	> 10 years					
Notes	No soil disturbance; low weed cover; small amount of dumped rubbish					

Taxon	Cover	Height
Acacia huegelii	1-2	40
Acacia pulchella var. *glaberrima*	+	50
Alexgeorgea nitens	10-30	20
Banksia menziesii	10-30	500
Bossiaea eriocarpa	+	20
Calytrix angulata	1-2	30
Conostephium minus	+	30
Conostephium pendulum	1-2	40
Conostylis juncea	+	30
Dampiera linearis	+	30
Dasypogon bromeliifolius	1-2	50
Drosera menziesii subsp. *penicillaris*	+	10
Ehrharta calycina	+	50
Eremaea pauciflora var. *pauciflora*	2-10	80
Gastrolobium capitatum	1-2	30
Gladiolus caryophyllaceus	+	30
Gompholobium scabrum	+	30
Gompholobium tomentosum	2	40
Haemodorum spicatum	+	100

Taxon	Cover	Height
Hibbertia aurea	1-2	30
Hovea trisperma	+	30
Hypolaena exsulca	+	30
Jacksonia floribunda	1-2	120
Laxmannia sessiliflora subsp. *australis*	+	20
Lepidosperma calcicola	+	40
Leptomeria empetriformis	1-2	50
Leucopogon conostephioides	+	30
Lomandra hermaphrodita	+	20
Lomandra micrantha subsp. *micrantha*	+	30
Lomandra sericea	2	40
Lyginia barbata	2-10	40
Macrozamia riedlei	+	20
Melaleuca seriata	+	30
Patersonia occidentalis	2-10	40
Petrophile linearis	1-2	40
Philotheca spicata	+	50
Phlebocarya ciliata	+	30
Schoenus curvifolius	+	30
Scholtzia involucrata	2-10	40
Stylidium repens	+	40
Tricoryne tenella	+	50
Xanthorrhoea brunonis	10-30	110
Xanthosia huegelii	+	20

PTAQ10

Described by C. Tauss		Date 26/10/2017		Site Type 10 m x 10 m Quadrat	
Location	Hepburn Ave, Ballajura				
MGA zone	50	Latitude: -31.84961		Longitude: 115.91960	
Habitat	Crest of dune				
Soil	Grey quartz sand				
Vegetation description	*Eucalyptus todtiana* and *Banksia menziesii* Low Woodland over *Eremaea pauciflora* and *Hibbertia hypericoides* Low Shrubland over *Alexgeorgea nitens* Rushland				
Vegetation condition	Very Good				
Fire age	> 10 years				
Notes	Relatively species poor; Altered structure – depleted shrub layer but regenerating well with Banksia and shrub seedlings evident; weed cover low; good cover of native rushes; no soil disturbance				

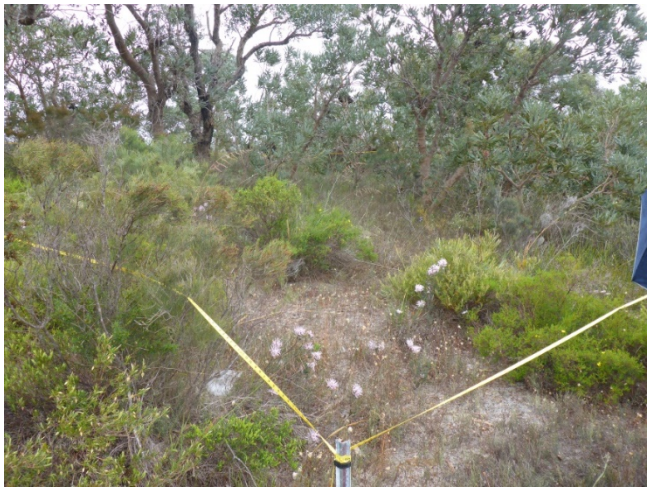
Taxon	Cover	Height
Acacia sessilis	+	100
Alexgeorgea nitens	30-70	20
Amphipogon turbinatus	+	20
Banksia attenuate	1	500
Banksia menziesii	2-10	300
Bossiaea eriocarpa	1-2	30
Briza maxima	1-2	30
Burchardia congesta	+	30
Caladenia flava subsp. *flava*	+	5
Calytrix angulata	1-2	30
Carpobrotus sp.	+	5
Centrolepis drummondiana	+	3
Conostephium pendulum	+	40
Dampiera linearis	+	30
Dasypogon bromeliifolius	+	30
Desmocladus flexuosus	1-2	30
Disa bracteate	+	20
Drosera menziesii subsp. *penicillaris*	+	10

Taxon	Cover	Height
Ehrharta calycina	1-2	100
Eremaea pauciflora var. *pauciflora*	10-30	100
Eucalyptus todtiana	2-10	400
Gladiolus caryophyllaceus	+	30
Gompholobium tomentosum	1-2	50
Haemodorum spicatum	+	50
Heliophila pusilla	+	10
Hibbertia hypericoides	2-10	80
Hovea pungens	+	40
Hypochaeris glabra	+	1
Hypolaena exsulca	2-10	30
Jacksonia floribunda	+	120
Laxmannia ramosa subsp. *ramosa*	+	10
Lepidosperma calcicola	+	40
Levenhookia stipitata	+	2
Leucopogon conostephioides	1-2	30
Lomandra caespitosa	+	40
Lomandra preissii	+	40
Lomandra sericea	1-2	30
Lyginia barbata	2-10	50
Lyginia imberbis	+	40
Opercularia vaginata	+	20
Patersonia occidentalis	+	40
Pentameris airoides	+	15
Petrophile linearis	1-2	30
Philotheca spicata	+	50
Scholtzia involucrata	+	50
Stirlingia latifolia	+	50
Stylidium repens	+	20
Trachymene pilosa	+	10
Ursinia anthemoides	1-2	20
Wahlenbergia capensis	+	20
Wahlenbergia preissii	+	10

PTAQ11						
Described by B. Morgan		Date 26/10/2017		Site Type 10 m x 10 m Quadrat		
Location	Hepburn Ave, Ballajura					
MGA zone	50	Latitude: -31.84838		Longitude: 115.91962		
Habitat	Mid-slope of low dune, north facing					
Soil	Grey quartz sand					
Vegetation description	*Eucalyptus todtiana* and *Banksia menziesii* Low Woodland over *Allocasuarina humilis* Shrubland over and *Hibbertia hypericoides, Conostephium pendulum* and *Astroloma xerophyllum* Low Open Shrubland over *Alexgeorgea nitens, Desmocladus flexuossa* and *Mesomelaena pseudostygia* Open Sedgeland					
Vegetation condition	Very Good					
Fire age	> 10 years					
Notes	High species-richness, low weed cover. Evidence of grazing					

Taxon	Cover	Height
Alexgeorgea nitens	15	20
Allocasuarina humilis	12	160
Amphipogon turbinatus	+	25
Anigozanthos humilis subsp. *humilis*	+	35
Arnocrinum preissii	+	40
Astroloma xerophyllum	+	60
Austrostipa compressa	+	40
Banksia menziesii	8	700
Bossiaea eriocarpa	+	20
Briza maxima	+	30
Burchardia congesta	+	60
Caladenia flava subsp. *flava*	+	12
Calytrix flavescens	+	35
Calectasia narragara	+	30
Chordifex sinuosus	+	40
Conostephium pendulum	1	35
Conostylis aculeata subsp. *cygnorum*	+	30
Conostylis setigera subsp. *Setigera*	+	12

Taxon	Cover	Height
Desmocladus flexuosus	4	20
Disa bracteata	+	25
Drosera menziesii subsp. *penicillaris*	+	12
Ehrharta calycina	+	70
Eremaea pauciflora var. *pauciflora*	+	35
Eucalyptus todtiana	11	600
Gladiolus caryophyllaceus	+	80
Gompholobium tomentosum	+	45
Haemodorum laxum	+	110
Haemodorum spicatum	+	110
Hibbertia hypericoides	1	40
Hybanthus calycinus	+	30
Hypocalymma robustum	+	110
Hypochaeris glabra	+	3
Jacksonia floribunda	+	110
Laxmannia squarrosa	+	15
Lepidosperma apricola	+	50
Lepidosperma calcicola	+	50
Leucopogon conostephioides	+	25
Levenhookia stipitata	+	4
Lomandra caespitosa	+	30
Lomandra nigricans	+	30
Lomandra preissii	+	30
Lomandra sp.	+	25
Lyginia barbata	+	45
Mesomelaena pseudostygia	2	40
Nuytsia floribunda	+	500
Opercularia vaginata	+	30
Patersonia occidentalis	+	40
Pentameris airoides subsp. *airoides*	+	30
Petrophile linearis	+	35
Philotheca spicata	+	130
Phlebocarya ciliata	+	40
Scaevola repens	+	15
Stirlingia latifolia	+	40
Stylidium repens	+	10
Thysanotus sparteus	+	120
Trachymene pilosa	+	10
Ursinia anthemoides	+	30
Wahlenbergia capensis	+	35



PTAQ12

Described by C. Tauss		Date 26/10/2017		Site Type 10 m x 10 m Quadrat		
Location	Hepburn Ave, Ballajura					
MGA zone	50	Latitude: -31.84871		Longitude: 115.94477		
Habitat	Upper slope of low dune					
Soil	Grey sand					
Vegetation description	*Eucalyptus todtiana* and *Banksia menziesii* Low Woodland over *Allocasuarina humilis* Open Shrubland over *Hibbertia hypericoides* and *Petrophile linearis* Low Shrubland over *Alexgeorgea nitens* Very Open Sedgeland					
Vegetation condition	Very Good					
Fire age	> 10 years					
Notes	Few weed species in low abundance. Evidence of past grazing and good regeneration in all strata; floristically intact but structurally modified; shrubs scattered and some native herbs missing					

Taxon	Cover	Height
Acacia pulchella var. *glaberrima*	+	50
Alexgeorgea nitens	2-10	20
Allocasuarina humilis	2-10	120
Amphipogon turbinatus	+	20
Astroloma xerophyllum	+	100
Austrostipa compressa	+	20
Banksia menziesii	10-30	600
Bossiaea eriocarpa	+	30
Briza maxima	+	20
Burchardia congesta	+	40
Caladenia flava subsp. *flava*	+	5
Calytrix angulata	+	30
Conostephium pendulum	+	60
Conostylis aculeata subsp. *cygnorum*	+	40
Dampiera linearis	+	30
Daviesia triflora	+	50
Desmocladus flexuosus	+	30
Drosera erythrorhiza subsp. *erythrorhiza*	+	1

Taxon	Cover	Height
Drosera menziesii subsp. *penicillaris*	+	10
Ehrharta calycina	+	110
Eucalyptus todtiana	2-10	500
Gastrolobium capitatum	1-2	50
Gladiolus caryophyllaceus	+	50
Gompholobium tomentosum	1-2	60
Haemodorum spicatum	+	120
Hibbertia huegelii	+	50
Hibbertia hypericoides	2-10	50
Hovea pungens	+	30
Hypocalymma robustum	1-2	50
Hypochaeris glabra	+	30
Laxmannia squarrosa	+	20
Lepidosperma calcicola	+	30
Leucopogon conostephioides	+	50
Levenhookia stipitata	+	5
Lomandra caespitosa	+	30
Lomandra caespitosa	+	1
Lomandra hermaphrodita	+	30
Lomandra nigricans	+	40
Lomandra preissii	+	60
Lyginia barbata	+	40
Lyginia imberbis	+	50
Macarthuria australis	+	50
Mesomelaena pseudostygia	+	40
Opercularia vaginata	1-2	30
Patersonia occidentalis var. *angustifolia*	+	50
Pentameris airoides subsp. *airoides*	+	30
Petrophile linearis	2-10	40
Philotheca spicata	+	60
Scaevola repens	1-2	10
Stirlingia latifolia	+	60
Trachymene pilosa	+	5
Ursinia anthemoides	+	10

PTAQ13

Described by C. Tauss		Date 27/10/2017		Site Type 10 m x 10 m Quadrat		
Location	Whiteman Park					
MGA zone	50	Latitude: -31.83497		Longitude: 115.95848		
Habitat	Wetland					
Soil	Black peat – waterlogged					
Vegetation description	*Melaleuca preissiana* Mid Open Forest over *Cyathochaeta teretifolia* and *Lepidosperma longitudinale* Closed Sedgeland					
Vegetation condition	Excellent					
Fire age	< 5 years					
Notes	Wetland maintained by artisian spring (seepage out of dune)					

Taxon	Cover	Height
Briza minor	+	5
Conyza sumatrensis	+	20
Cyathochaeta teretifolia	30-70	120
Cynodon dactylon	+	2
Cyperus sp.	+	8
Dielsia stenostachya	+	90
Eucalyptus rudis subsp. *rudis*	+	300
Hydrocotyle diantha	+	5
Juncus pallidus	+	150
Lagenifera huegelii	+	10
Lepidosperma longitudinale	2-10	70
Lobelia anceps	+	30
Lotus subbiflorus	+	10
Melaleuca preissiana	30-70	1800
Melaleuca rhaphiophylla	+	400
Microlaena stipoides	+	30
Patersonia occidentalis subsp. *angustifolia*	1-2	100
Pentameris airoides subsp. *airoides*	+	15
Sphaerolobium vimineum	+	120
Symphyotrichum subulatum	+	150
Taxandria linearifolia	+	200

PTAQ14

Described by B. Morgan		Date 27/10/2017		Site Type 10 m x 10 m Quadrat		
Location	Whiteman Park					
MGA zone	50	Latitude: -31.83290		Longitude: 115.96286		
Habitat	Wetland					
Soil	Black peat - waterlogged					
Vegetation description	*Melaleuca preissiana* Low Mid Closed Forest over *Taxandria linearifolia* Tall Open Shrubland over *Dielsia stenostachya* and *Cyathochaeta avenacea* Sedgeland					
Vegetation condition	Excellent					
Fire age	> 10 years					

Taxon	Cover	Height
Acacia sp.	+	30
Aotus gracillima	+	40
Briza maxima	+	20
Briza minor	+	25
Burchardia bairdiae	+	70
Cyathochaeta avenacea	23	50
Dielsia stenostachya	30	40
Hypochaeris glabra	+	1
Lepidosperma longitudinale	1-2	90
Lobelia anceps	+	25
Lotus subbiflorus	+	8
Microtis media	+	30
Patersonia occidentalis var. *angustifolia*	+	100
Pterostylis sp.	+	30
Schoenus efoliatus	+	50
Thysanotus gracilis	+	40
Taxandria linearifolia	4	280
Xanthorrhoea brunonis	+	100
Xanthorrhoea preissii	5	180
Melaleuca preissiana	85	600

PTAQ15						
Described by B. Morgan		Date 27/10/2017		Site Type 10 m x 10 m Quadrat		
Location	Whiteman Park					
MGA zone	50	Latitude: -31.83304		Longitude: 115.96223		
Habitat	Base of gently sloping dune					
Soil	Black peaty sand					
Vegetation description	*Corymbia calophylla* Mid Closed Forest over *Xanthorrhoea preissii* Shrubland over *Dielsia stenostachya* Closed Sedgelend					
Vegetation condition	Excellent					
Fire age	> 10 years					
Notes	Low disturbance					

Taxon	Cover	Height
Arnocrinum preissii	+	30
Billardiera fusiformis	+	20
Briza maxima	+	30
Bromus diandrus	+	30
Burchardia congesta	+	35
Caladenia latifolia	+	10
Corymbia calophylla	80	1500
Dielsia stenostachya	70-80	35
Hypocalymma angustifolium	+	40
Lomandra preissii	+	60
Lotus subbiflorus	+	20
Olea europaea	+	50
Patersonia occidentalis var. *angustifolia*	+	25
Pterostylis sanguinea	+	15
Xanthorrhoea preissii	15-20	130
Zantedeschia aethiopica	+	15

PTAQ20

Described by C. Tauss		Date 30/10/2017		Site Type 10 m x 10 m Quadrat	
Location	Whiteman Park				
MGA zone	50	Latitude: -31.82067		Longitude: 115.95752	
Habitat	Lower slopes of low dune; flat; dampland				
Soil	Black-brown sandy peat. Dry at surface				
Vegetation description	*Melaleuca preissiana* Mid Open Forest over *Taxandria linearifolia* Closed Tall Scrub over *Pteridium esculentum* Shrubland over *Cyathochaeta teretifolia* Sedgeland				
Vegetation condition	Very Good				
Fire age	< 3 years				
Notes	No soil disturbance; species depauperate; evidence of recent (< 3 years) fire; high abundance of *Pteridium esculentum* (bracken) indicates historical disturbance; possible grazed by livestock in the past. Best example of this vegetation type sampled for the current survey				

Taxon	Cover	Height
Aotus cordifolia	+	20
Arctotheca calendula	+	10
Briza maxima	+	10
Conyza sumatrensis	+	5
Cyathochaeta teretifolia	30-70	200
Hydrocotyle diantha	2-10	3
Hypochaeris glabra	+	10
Lysimachia arvensis	+	10
Melaleuca preissiana	30-70	1500
Microlaena stipoides	+	10
Monopsis debilis	+	10
Pteridium esculentum	10-30	200
Sonchus asper	+	5
Sphaerolobium vimineum	+	40
Taxandria linearifolia	70-100	400
Trachymene pilosa	+	5
Xanthosia huegelii	+	10

PTAQ21

Described by B. Morgan		Date 31/10/2017		Site Type 10 m x 10 m Quadrat	
Location	Whiteman Park				
MGA zone	50	Latitude: -31.81927		Longitude: 115.95752	
Habitat	Gentle slope of very low rise on plain; adjacent to dampland				
Soil	Grey sand				
Vegetation description	*Corymbia calophylla* Mid Open Forest over *Xanthorrhoea preissii* Open Shrubland				
Vegetation condition	Good				
Fire age	5-8 years				
Notes	Species depauperate; low weed cover				

Taxon	Cover	Height
Briza maxima	+	30
Briza minor	+	20
Bromus diandrus	+	20
Caladenia flava subsp. *flava*	+	10
Caladenia hirta subsp. *hirta*	+	30
Caladenia latifolia	+	30
Corymbia calophylla	60-70	1300
Ehrharta longiflora	+	10
Hypochaeris glabra	+	3
Kennedia prostrata	1	20
Microtis media	+	30
Pentameris airoides subsp. *airoides*	+	20
Solanum nigrum	+	30
Trifolium campestre	+	12
Vulpia myuros	+	35
Xanthorrhoea preissii	9-10	110

Appendix F

Morley-Ellenbrook Line: Targeted *Caladenia huegelii* Search 2018 (RPS)

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RPS Australia West Pty Ltd ABN 42 107 962 872
A member of the RPS Group Plc

29 January 2019

Attn: Mark Erskine
METRONET
one40 William Street
PERTH WA 6000

Our ref: EEL17158.002
Via: Email

Dear Mark

Morley-Ellenbrook Line: Targeted *Caladenia huegelii* Search 2018

Background

METRONET has undertaken a route options analysis to derive an indicative alignment for the Morley-Ellenbrook Line (MEL) transit option. The current option under consideration is a 21 kilometre (km) rail line running north from the existing Bayswater Station on the Midland line to the Ellenbrook town centre. This option is located within the City of Bayswater and City of Swan.

The subject of this study is the current alignment, in the area of Whiteman Park, and encompasses a 1,194.87 ha indicative development envelope, which includes the transit corridor and provision for construction and access areas (Figure 1).

RPS Australia West Pty Ltd (RPS) was engaged by METRONET to undertake a review of remnant Banksia woodland vegetation within the indicative development envelope in terms of its potential to support *Caladenia huegelii* (grand spider orchid).

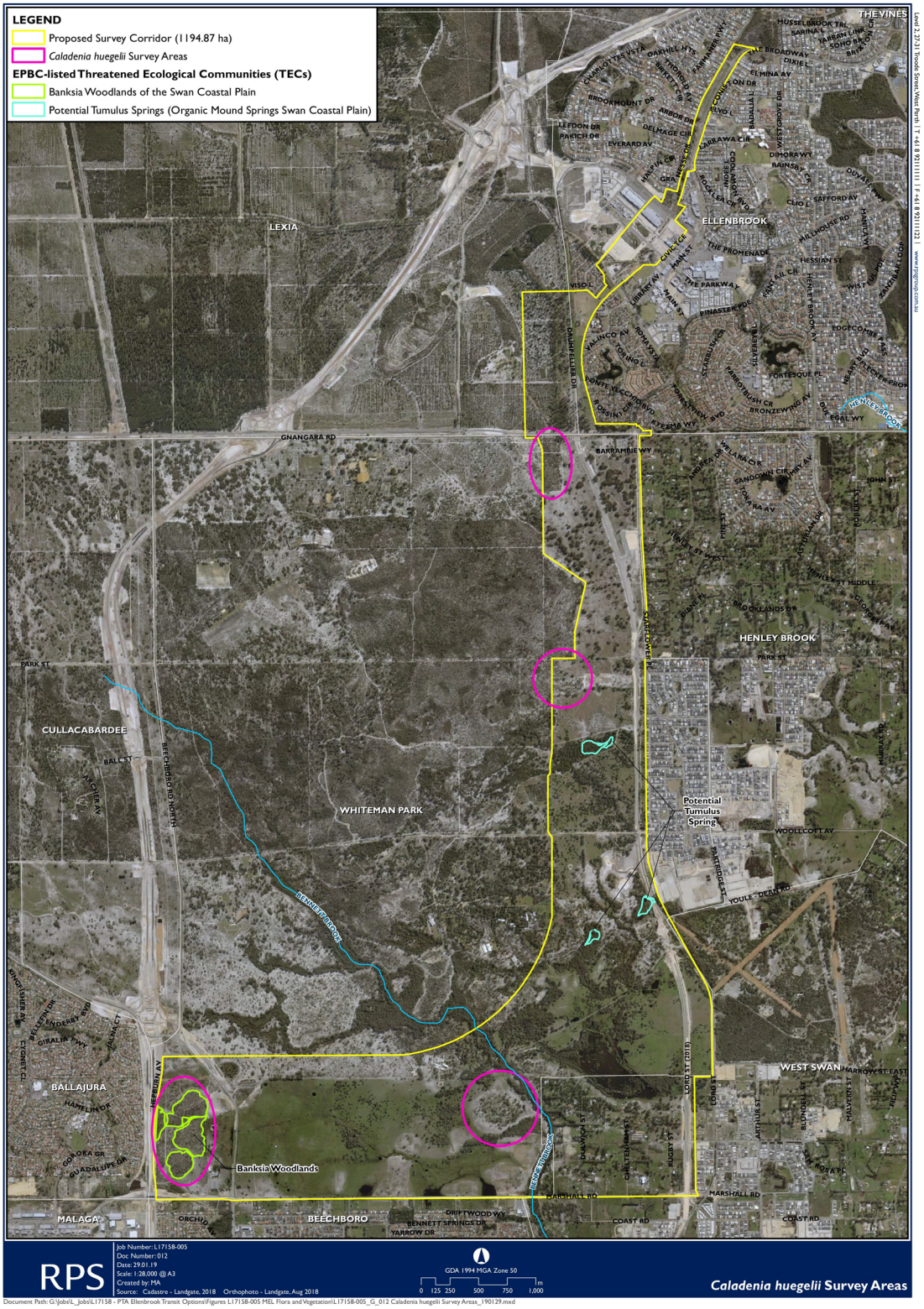

Figure 1 **MEL Indicative Development Envelope (The remnant Banksia woodland vegetation extents subject to the targeted *Caladenia huegelii* search are circled).**

Species Description and Habitat Requirements

C. huegelii is listed as Threatened[1] (T) in Western Australia, and protected under the *Wildlife Conservation Act 1950* (WC Act). The species is also listed as Endangered[2] (E) and protected federally under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

C. huegelii is a tuberous perennial herb belonging to the family Orchidaceae. It grows up to 60 centimetres (cm) tall with a single erect, pale green, hairy leaf and one or two (rarely three) pale greenish-cream flowers 7–10 cm across, with variable suffusions, lines and spots of red–maroon. The large labellum has a pale greenish-cream base and a dark maroon recurved apex (Plate 1). The labellum has distinctively long, fine, sometimes split fringes, extending well above the column (Western Australian Herbarium (WAH) 2018; Department of Environment and Conservation (DEC) 2009).

Plate 1: ***Caladenia huegelii*** **(grand spider orchid)**

[1] **T: Threatened Flora (Declared Rare Flora — Extant)** – Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 of the Wildlife Conservation (Rare Flora) Notice under the WC Act).

[2] **E: Endangered** – A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.

C. huegelii occurs in mixed woodland of *Eucalyptus marginata*, *Banksia attenuata*, *B. ilicifolia* and *B. menziesii* with scattered *Allocasuarina fraseriana* and *Corymbia calophylla* over dense shrubs of *Stirlingia latifolia, Hypocalymma robustum*, *Hibbertia hypericoides*, *H. subvaginata*, *Xanthorrhoea preissii*, *Adenanthos cuneatus* and *Conostylis* species. Throughout its range the species tends to favour areas of dense undergrowth and occurs on deep grey–white sand associated predominantly with the Bassendean sand dune system (DEC 2009).

C. huegelii has been recorded at several locations within a 5 km radius of the indicative development envelope, the closest of which was in Banksia woodland to the east of Beechboro Road North and south of Gnangara Road.

A targeted search during the documented flowering time of the species between mid-September and mid-October (DEC 2009) is required to identify presence of the species.

Methodology

In preparation for the targeted search, on 21 September a brief reconnaissance search was undertaken of Banksia woodland vegetation at Fraser Road in Banjup to ascertain the emergence and flowering status of a large known population (Population 42). This population was found to be in full flower at the time of the search.

The targeted *C. huegelii* search of the indicative development envelope was undertaken on Friday 28 September 2018 by RPS botanists Caroline Gill and Julijanna Hantzis, in accordance with current guidance on surveying Australia's threatened orchids listed under the EPBC Act (Commonwealth of Australia [CoA] 2013).

The search involved a systematic grid-based search along transects spaced 10 metres apart within all the remnant Banksia Woodland vegetation with an intact native understorey. The areas of remnant Banksia Woodland vegetation searched are identified in Figure 1.

Results

No *C. huegelii* individuals were observed in any of the remnant Banksia Woodland vegetation within the indicative development envelope during the 2018 targeted search.

Discussion and Conclusions

Target searching for cryptic orchid species, such *C. huegelii,* presents many challenges. Year to year populations may fluctuate in abundance, occurrence or delectability, often unpredictably (CoA 2013). Environmental conditions such as drought or unseasonal rain events can influence whether, and when, terrestrial orchid species emerge in a given season, and many species have the potential to remain dormant in the form of an underground tuber for up to three years if conditions are not favourable (CoA 2013).

The survey guidelines state "The failure to find orchids in drought years or when rainfall events do not occur at the right time does not necessarily mean that they are truly absent" and "The proportion of flowering to non-flowering plants is influenced by environmental conditions; therefore, the species may be present but overlooked when only non-flowering plants are present. In addition, not all plants in a population or different populations are likely to flower at the same time". These are important considerations when conducting orchid searches.

Climate data retrieved from the Bureau of Meteorology (BoM 2019) show that 2018 was an average rainfall year (with 743.8 mm of rain received for the 12-month period representing approximately 97 % of the 75-year average of 766.7 mm). It should be noted also that around 30 % more rain (than the long-term average)

was recorded for July and August 2018 which resulted in an excellent survey season in the Perth Metropolitan Region (PMR). Environmental conditions for the year were generally considered favourable for the emergence and detectability of terrestrial orchid species. Confirmation (prior to undertaking the targeted search within the survey area) that the Banjup population of *Caladenia huegelii* (Population 42) was in full flower at the time also demonstrates that the season conditions were favourable for the species.

Despite the 2018 season being considered favourable, according to guidelines for detecting orchids (CoA 2013), for an assessment to be considered 'comprehensive', surveys should be undertaken over three consecutive years. RPS recommends undertaking an additional survey for the species in the same areas in Spring 2019 or initiating a discussion with DBCA around whether they consider additional surveys necessary for this area.

Should you require further details or clarification, please do not hesitate to contact me.

Yours sincerely

RPS
Caroline Gill
Managing Scientist - Botany

References

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Appendix G

Morley-Ellenbrook Line: *Caladenia huegelii* Targeted Flora Survey (Eco Logical Australia 2020)

Morley-Ellenbrook Line:
Caladenia huegelii Targeted Flora Survey

Public Transport Authority

MEL-MNO-ELA-EN-RPT-0011.0

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DOCUMENT TRACKING

Project Name	Morley -Ellenbrook Line: *Caladenia huegelii* Targeted Flora Survey
Project Number	14108
Project Manager	Daniel Brassington
Prepared by	Daniel Brassington
Reviewed by	Jeff Cargill
Approved by	Jeff Cargill
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ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd

Template 2.8.1

Contents

List of Figures

Abbreviations

Abbreviation	Description
CALM	Department of Conservation and Land Management
CoA	Commonwealth of Australia
DBCA	Department of Biodiversity, Conservation and Attractions
DEC	Department of Environment and Conservation
DPAW	Department of Parks and Wildlife
ELA	Eco Logical Australia Pty Ltd
MEL	Morley-Ellenbrook Line
PTA	Public Transport Authority
WA	Western Australia

Executive Summary

Eco Logical Australia Pty Ltd was engaged by the Public Transport Authority to undertake a targeted survey for the Threatened orchid species *Caladenia huegelii* (Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* listed as Endangered; State *Biodiversity Conservation Act 2016* listed as Critically Endangered). This survey served to provide an additional temporal component to previous survey work undertaken by RPS in 2018.

Four sites at Whiteman, Western Australia (WA) were identified by RPS as providing suitable habitat for *Caladenia huegelii* within the Morley-Ellenbrook Line project development envelope. These areas contain, to varying degrees, '*Mixed Woodland of Jarrah and Banksia with scattered Sheoak and Marri*' favoured by *Caladenia huegelii* as specified in the Grand Spider Orchid (*Caladenia huegelii*) Recovery Plan.

Eco Logical Australia reassessed the four sites previously identified and surveyed by RPS over three days in late September 2019, utilising the methodology outlined in the Environmental Protection Authority (EPA) *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* and the draft threatened orchid survey guidelines.

No individuals of *Caladenia huegelii* were detected during the 2019 targeted survey. Survey timing was considered appropriate based on known flowering times, and discussions with relevant stakeholders stating that known populations were flowering at the time of the current survey. This finding supports previous survey results by RPS, where similarly no individuals were recorded within the four sites.

1. Introduction

1.1 Project background

Eco Logical Australia (ELA) was engaged by the Public Transport Authority (PTA) to resurvey four locations previously identified by RPS (2019) as containing suitable habitat for the Threatened Flora *Caladenia huegelii* within the Morley-Ellenbrook Line (MEL) project area. More specifically, these areas were near Whiteman Park, Whiteman Western Australia (**Figure 1**). The survey aimed to provide an additional temporal component to determine the presence/absence of this species.

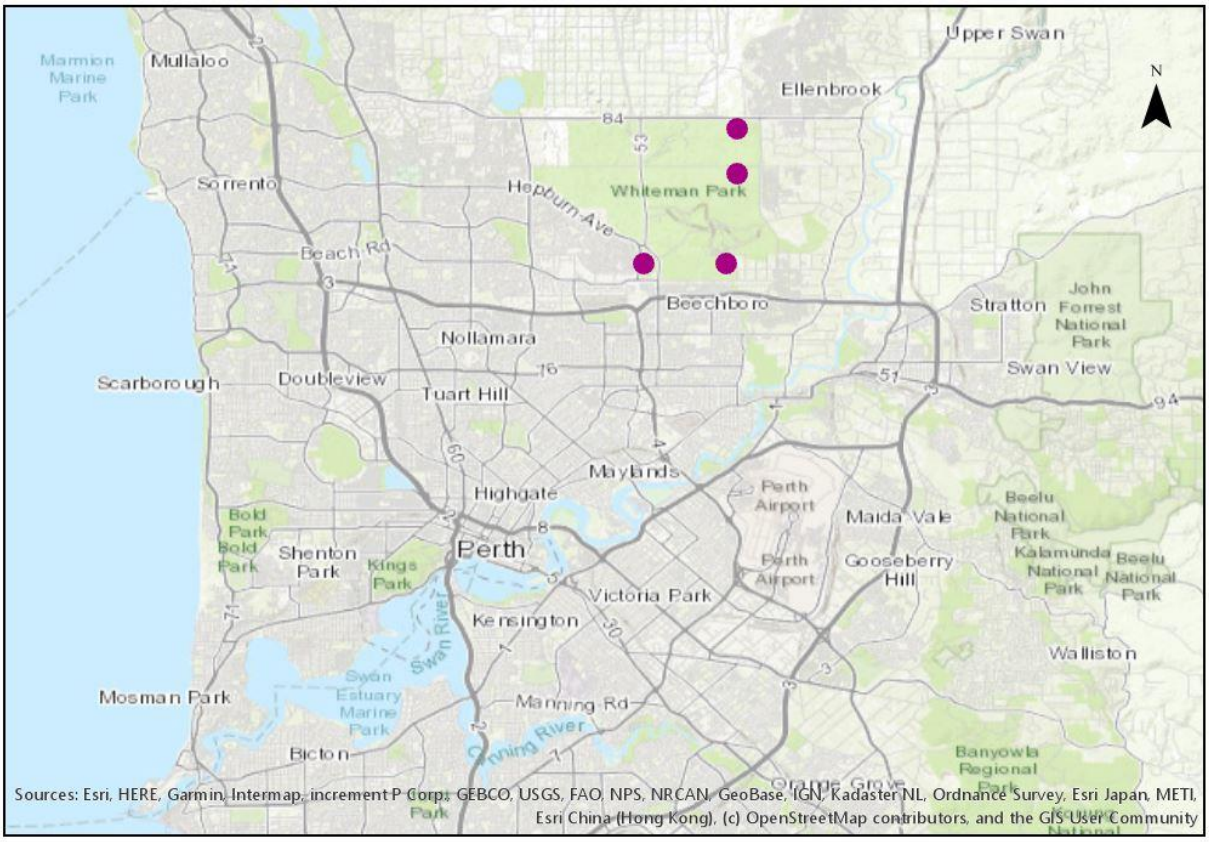

Figure 1: The location of the survey targets within the Perth metro area, shown as coloured points

All four areas are located within the proposed development envelope of the MEL project and were discrete sites identified as containing suitable *Caladenia huegelii* habitat (RPS 2019). Suitable habitat requirements as described in the *Grand Spider Orchid Recovery Plan* (DEC 2009) comprise mixed woodland of *Eucalyptus marginata*, *Banksia attenuata*, *B. ilicifolia* and *B. menziesii* with scattered *Allocasuarina fraseriana* and *Corymbia calophylla*.

Caladenia huegelii is listed as Threatened Flora (Declared Rare Flora – Extant) under Part 2 of the *Biodiversity Conservation Act 2016* (BC Act) and listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. It is known from 33 populations on the Swan Coastal Plain with more than 85% of known plants recorded from two of these populations (DBCA 2019). It has been found to associate with grey sandy soils of the Bassendean and rarely Spearwood

dune systems between Wanneroo and Busselton, where it is also relies on a specific fungus and wasp species essential to its reproductive cycle and ongoing survivability.

The orchid is known to remain dormant in the soil profile for several years without producing flowering parts essential to identification (DEC 2009), thus these four areas have been surveyed previously in September 2018 by RPS.

Although *Caladenia huegelii* was not found in the 2018 survey (RPS 2018), there is still the potential for it to occur in these areas, as the species is stated in the Recovery Plan (DEC 2009) to remain as a dormant vegetative tuber for up to two years without producing a vegetative leaf and longer without flowering.

1.2 Survey area

Four areas as shown in **Figure 2**, were identified by RPS (2019) as containing potential *Caladenia huegelii* habitat. These areas are either within or adjacent to Whiteman Park, Whiteman and contain remnant Banksia/ Eucalyptus/ Allocasuarina woodland. For the purpose of this survey, they shall hence be referred to as Site A to Site D, as shown below.

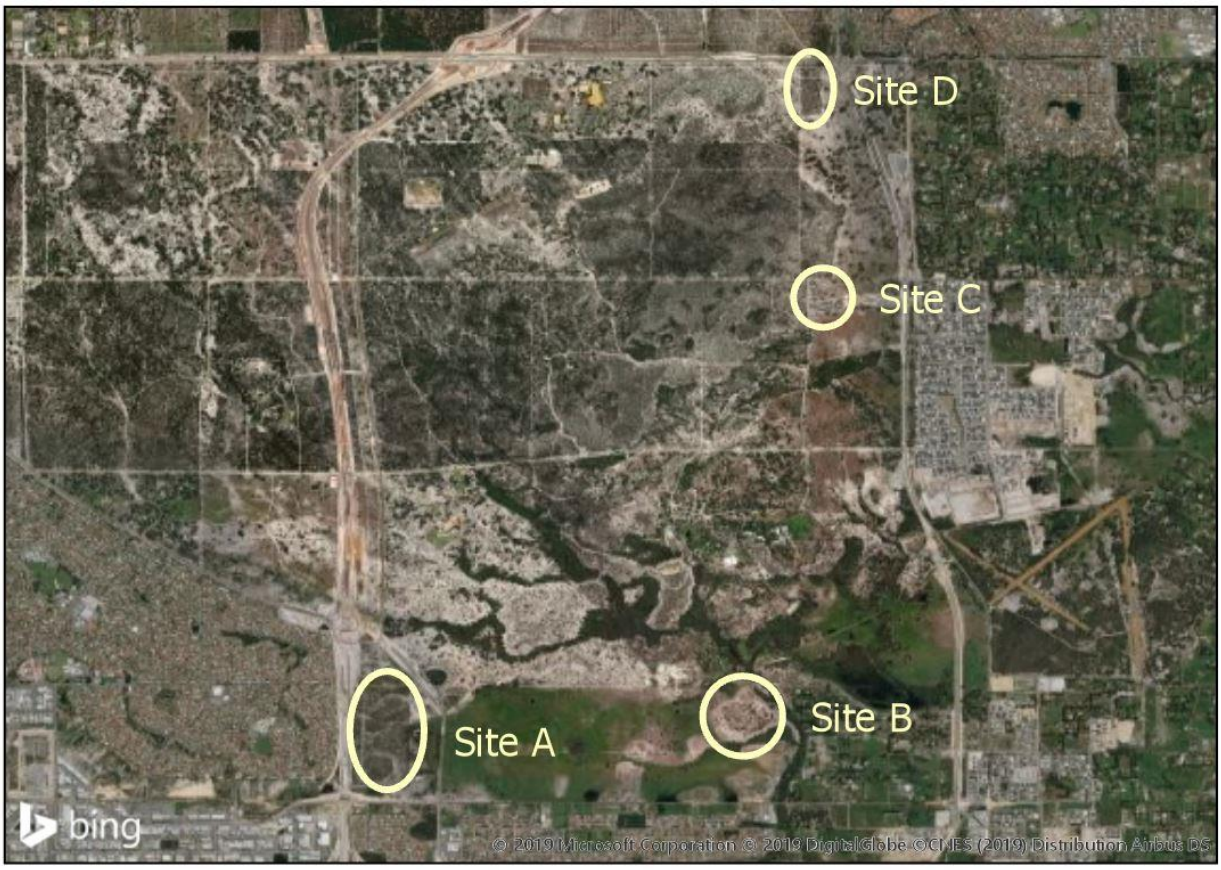

Figure 2: The four survey areas as defined by RPS (2019), coded here as Sites A to D.

2. Methodology

The methodology for this survey was aligned with that used by RPS (2019) and as outlined in the Environmental Protection Authority (EPA) *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) and Draft Survey Guidelines for Threatened Orchids (CoA 2013).

2.1 Field survey

The targeted flora survey was carried out by two ELA staff members, led in the field by an experienced botanist, over three days between 26th to 28th September 2019. The four target areas previously identified by RPS were intensively traversed by foot at five to ten-metre intervals in a regular linear pattern. Track logs were represented on aerial photography are provided in **Appendix A**.

Any occurrences of *Caladenia* species were recorded by GPS waypoint and photographed for later confirmation of identification. A representative photo was taken of the survey area and a brief description also taken. Track logs were also taken for confirmation of survey coverage. Vegetation condition ratings were provided for each site. It should be noted that it was not the intention of this survey to map vegetation condition in detail, but rather to provide context in determining the suitability of habitat to support *Caladenia huegelii*.

The survey methodology sought to replicate works undertaken by RPS (RPS 2019) in line with the methodology outlined in CoA (2013) and EPA (2016); the exception being a site visit to the Banjup *Caladenia huegelii* population. After consultation with relevant stakeholders regarding the flowering status of other known *Caladenia huegelii* populations (refer to Section 2.2), a site visit to Banjup was not considered necessary and the additional time was invested in increasing survey effort within the four target areas.

2.2 Survey timing

Survey guidelines for orchids recommend that survey timing be selected to coincide with flowering periods to maximise the likelihood of detection and identification (CoA 2013; EPA 2016). Flowering periods can be confirmed by checking known locations with similar habitat and climate influences, which are key drivers for emergence and flowering.

The method originally proposed for this survey included the option of visiting a known population of *Caladenia huegelii* at Banjup. The purpose of this visit was to confirm that *Caladenia huegelii* was in flower prior to surveying the target sites in Whiteman Park, thereby maximising the likelihood that *Caladenia huegelii* in Whiteman Park (if present) would be in flower and could be detected and identified in the field. The Banjup population was chosen because it has similar habitat and climate to the target location in Whiteman Park. It also contains many individuals, making it easier to determine if in flower or not.

Before any fieldwork had commenced, other information about *Caladenia huegelii*'s flowering status was provided to ELA, and other information sources were consulted. Discussions with relevant state regulators and photographic evidence provided by the *Western Australian Native Orchids* group confirmed that populations of *Caladenia huegelii* and other *Caladenia* species were flowering at the time

of the current survey. In addition, *Caladenia huegelii* populations within the Jandakot Airport Conservation Precincts and Ken Hurst Park (both similar habitats and climates compared to Whiteman Park) were confirmed to be in peak flower at the time of the current survey (Joanne Wann [Environmental Manager – Jandakot Airport], pers. comm. 2019). Western Australian Orchid expert Dr. Andrew Brown also confirmed that known *Caladenia huegelii* populations were still flowering in early October (pers. comm. 2019). The multiple reliable sources of positive confirmation that *Caladenia huegelii* was in flower effectively removed the need to visit the Banjup population.

Accordingly, the survey timing was considered appropriate and consistent with the relevant survey guidelines.

3. Results

3.1 *Caladenia huegelii* targeted flora survey

No individuals of *Caladenia huegelii* were recorded within the four targeted survey areas.

3.2 Survey areas

3.2.1 Site A

Site A consisted of remnant vegetation located between Tonkin Hwy and Beechboro Rd North (**Figure 2**). There were three broad vegetation types within this area, *Eucalyptus* and *Banksia* woodland on sandy rises or low hills, *Nuytsia* woodland over *Xanthorrhoea* shrubland and thirdly, *Melaleuca* and *Acacia* tall shrubland in the swales and depressions.

Vegetation was considered to be in good to pristine condition (Keighery 1994) with the majority of native vegetation forming several distinct strata with weedy species comprising a minor component of the understory.

Several Orchid species were recorded either flowering or just past flowering, including *Caladenia flava* subsp. *flava*, *Diuris magnifica*, *Pterostylis* sp., *Microtis media* subsp. *media* and *Caladenia paludosa* x *arenicola* hybrid.

Figure 3: Representative photograph of Site A

3.2.2 Site B

Site B was situated within an agricultural area managed by Whiteman Park and consisted of remnant mature *Eucalyptus* and *Banksia* trees over a predominantly weedy ground layer (**Figure 2**). The site was degraded and subject to grazing and soil disturbance activities by large numbers of kangaroos and some cattle.

The understorey predominately comprised of annual and perennial weed species, with few native species being present; as such Site B was considered to be in degraded condition (Keighery 1994). One Orchid was recorded, *Caladenia flava* subsp. *flava* where it was protected under a *Eucalyptus'* low hanging foliage.

Figure 4: Representative photograph of Site B

3.2.3 Site C

Site C comprised a patch of remnant bushland on a low sandy hill in an historical agricultural area (**Figure 2**). The site is currently destocked and managed within the bounds of Whiteman park. The vegetation consisted of *Banksia*, *Eucalyptus*, *Allocasuarina* and *Nuytsia* woodland with a sparse native understory and moderately weedy ground strata. There was a large population of kangaroos observed grazing in the cleared ex-agricultural area surrounding the remnant bushland. Vegetation was considered to be in good condition (Keighery 1994) based on the diversity and abundance of native vegetation in the upper and mid strata, in spite of the moderate weedy presence in the ground layer.

The orchid *Caladenia flava* subsp. *flava* was recorded within this site.

Figure 5: Representative photograph of Site C

3.2.4 Site D

Site D contained a block of remnant vegetation fenced off and signposted as conservation area bound by cleared ex-agricultural lands to the east and south, partially cleared bushland to the west and Gnangara Rd to the north (**Figure 2**).

Vegetation within this block consisted of *Banksia* (mixed species) woodland with occasional *Eucalyptus* and *Allocasuarina* over a mixed mid shrub layer. Vegetation was in very good condition (Keighery 1994) with well-preserved native strata and relatively few weed species in the understory and ground strata. Dieback was potentially present within this site, here with many Banksia species showing minor symptoms.

The orchid *Caladenia flava* subsp. *flava* was noted here along with an orchid with a broadly obovate basal leaf but no flowering material to enable positive identification.

Figure 6: Representative photograph of Site D

4. Discussion

No *Caladenia huegelii* individuals were recorded during the current survey. This finding corresponds with prior data recorded by RPS during their 2018 survey, where it was also reported that no individuals of *Caladenia huegelii* were found within these four areas (RPS 2019).

4.1 Survey timing

Survey timing was appropriate based on known flowering times (DEC 2009), and discussions with relevant stakeholders stating that known populations of *Caladenia huegelii* were flowering at the time of the current survey (refer to Section 2.2).

The presence of numerous orchids flowering in the four target survey areas, including a hybrid of the closely related Carousel Spider Orchid *Caladenia arenicola* found within the Site A, indicate that conditions supporting *Caladenia* flowering were also appropriate. As such, it may be inferred that if *Caladenia huegelii* were present, it would also be in a flowering stage. The absence of flowering individuals found in both this survey and the survey conducted in 2018 by RPS suggests that *Caladenia huegelii* does not occur within the four target areas. It should be noted however, that given the cryptic nature of this species definitive statements regarding its presence/absence within the four sites are unable to be provided.

4.2 Habitat suitability at each site

The Grand Spider Orchid *Caladenia* huegelii Recovery Plan (DEC 2009) described this species as preferring a dense shrub understory of *Stirlingia latifolia*, *Hibbertia hypericoides*, *H. subvaginata*, *Xanthorrhoea preissii*, *Adenanthos* and *Conostylis* species. As such, the density of the remnant native understory in the survey areas can be considered an important component in determining the suitability of habitat for the presence of *Caladenia huegelii*.

4.2.1 Site A

Remnant vegetation within this site was recorded to be in good condition, with a relatively intact understory at this site. As such, this site was considered to comprise suitable habitat to support the orchid *Caladenia huegelii*.

The presence of other *Caladenia* species in peak flowering period or just past peak flowering, including a hybrid of the related species *C. arenicola* indicate that seasonal conditions encouraged flowering in this group and suggest that *Caladenia huegelii* would also be flowering if individuals of this species were present in the survey area.

Despite the presence of suitable habitat and optimum flowering conditions, no individuals of *Caladenia huegelii* were recorded; supporting findings provided by RPS (2019), which also did not detect this species.

4.2.2 Site B

The degraded nature of Site B, due to extensive livestock trampling and high weed density, has led to the almost complete absence of native understory species. As a result, this area was not considered to comprise suitable supporting habitat for *Caladenia huegelii*. This species was not detected during the current or previous survey undertaken by RPS (2019).

4.2.3 Site C

Site C comprised a mostly intact overstorey structure, however historic stocking and grazing have resulted in a disturbed soil profile and relative absence of native mid- and understorey species. As a result, this area was not considered to comprise suitable supporting habitat for *Caladenia huegelii*. This species was not detected during the current or previous survey undertaken by RPS (2019).

4.2.4 Site D

Site D was considered to be in very good condition with an intact native structure being present. As such, this site was considered to comprise suitable habitat to support the orchid *Caladenia huegelii*.

Possible symptoms of dieback in the form of the invasive mycorrhizal fungus *Phytophthora cinnamomi* were observed to be present within the site. This fungus is listed as a threat to *Caladenia huegelii* in the *Grand Spider Orchid Recovery Plan* (DEC 2009) and lowers the likelihood of the orchid's presence through removal of overstory leading to changes in the understory and canopy opening. Information pertaining to the dieback status of Site D was sought to confirm field observations. Dieback mapping by Terratree (2017) listed Site D as dieback infested, with plant disease symptoms consistent with the presence of *Phytophthora cinnamomi* being recorded.

The presence of other *Caladenia* species in peak flowering period or just past peak flowering, suggests that *Caladenia huegelii* would have also been flowering if individuals of this species were present in the survey area. Despite the presence of suitable habitat and optimum flowering conditions, no individuals of *Caladenia huegelii* were recorded; supporting findings provided by RPS (2019), which also did not detect this species.

5. Recommendations

Two consecutive targeted *Caladenia huegelii* surveys have now completed within Sites 1 – 4 (2018 and 2019; **Figure 2**), with no individuals being recorded. The current survey identified two sites, namely Site A and Site D, that comprised suitable habitat to potentially support the presence of *Caladenia huegelii*. Conversely, Site B and Site C were not considered to comprise suitable habitat to support the presence of *Caladenia huegelii.*

Survey Guidelines for Australia's Threatened Orchids states that many terrestrial orchid species have the capacity to survive for up to three years before favourable conditions allow for emergence (CoA 2013). Therefore, it is recommended that a third and final targeted *Caladenia huegelii* survey be undertaken within Sites A and D in Spring 2020. Given the degraded nature of Sites B and C, additional surveys are likely not warranted as suitable habitat was not considered to be present.

6. References

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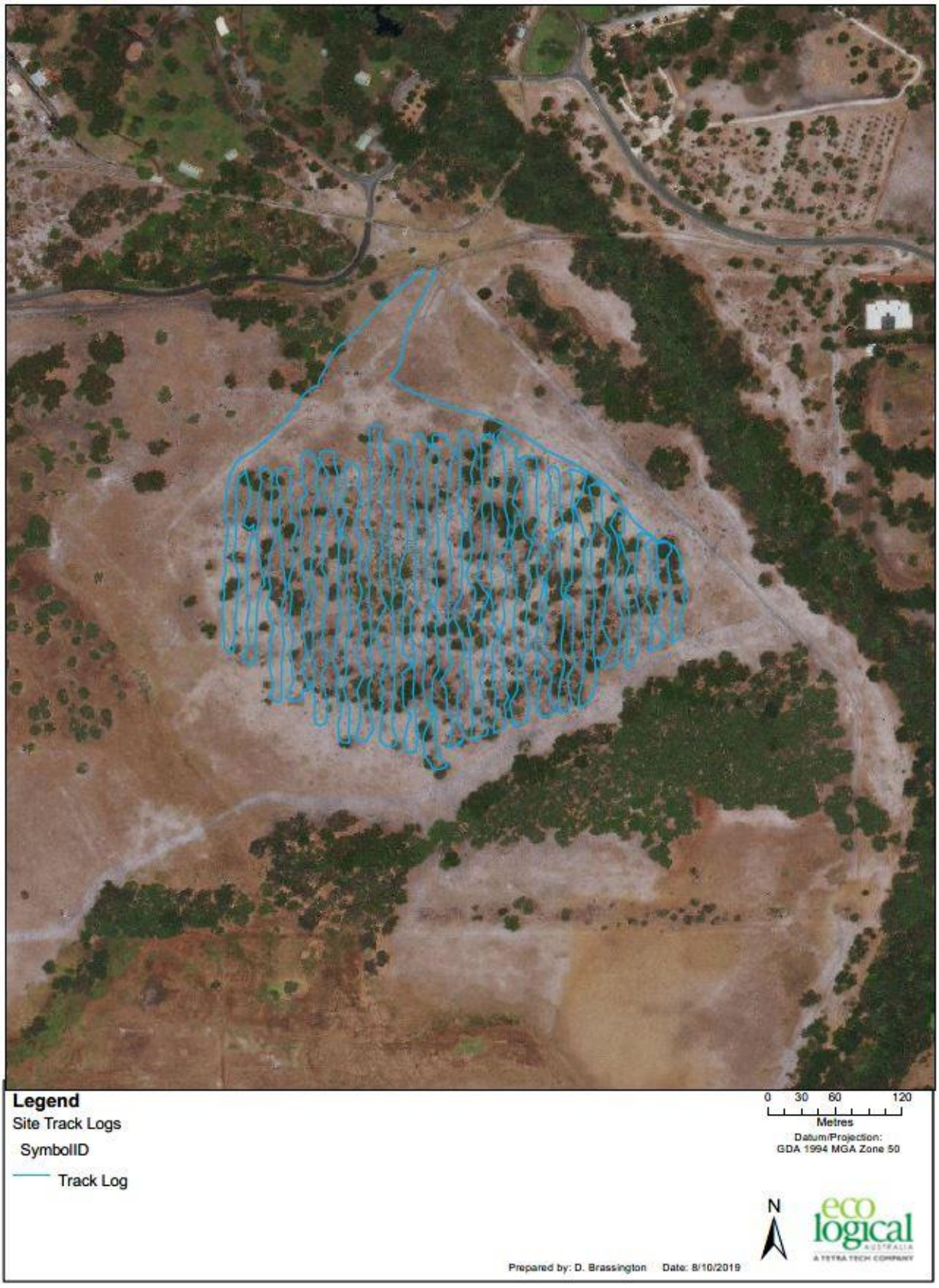
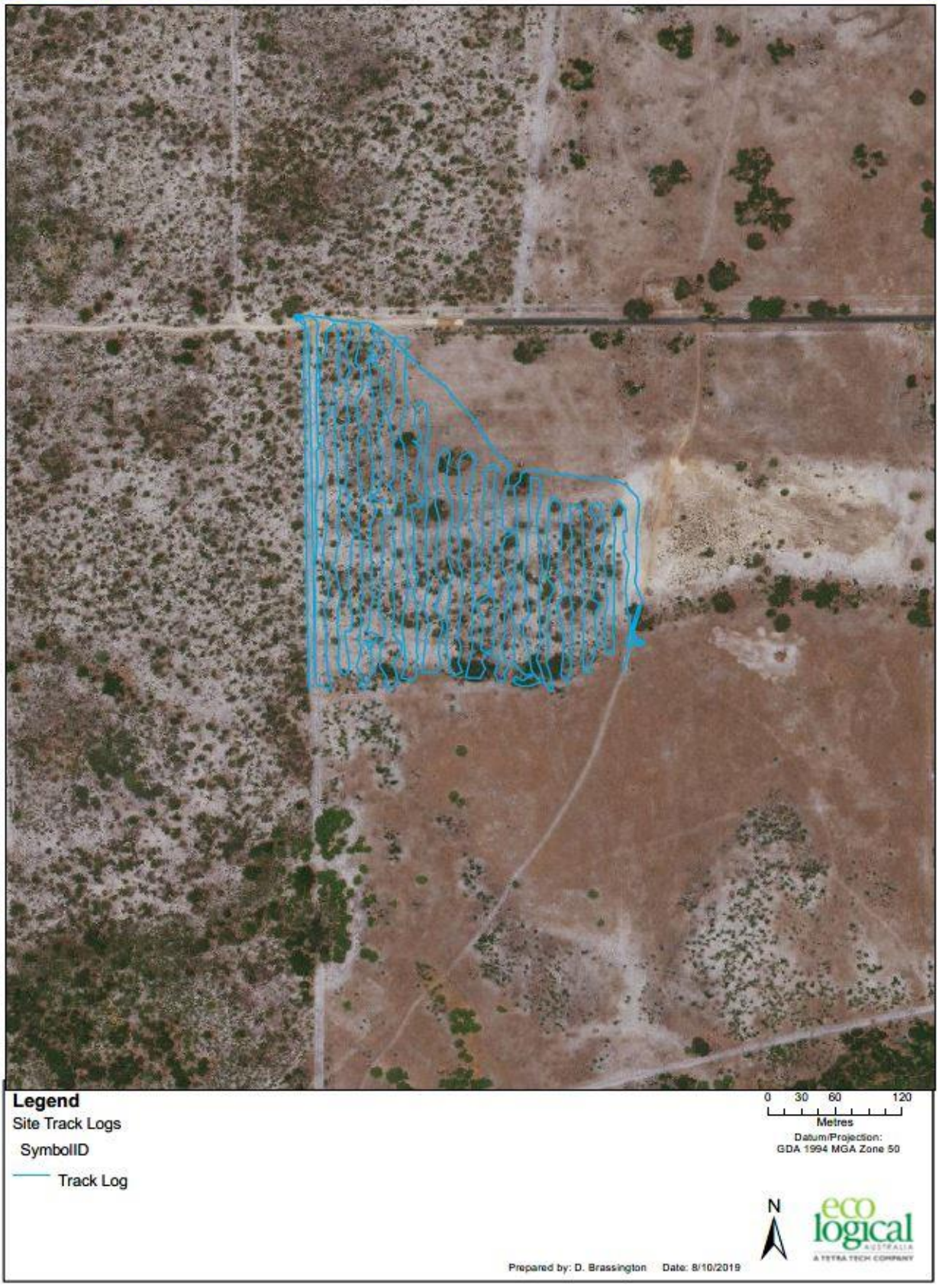
Appendix A Track Log Records

Track Logs for Site B



Track Logs for Site C



Track Logs for Site D

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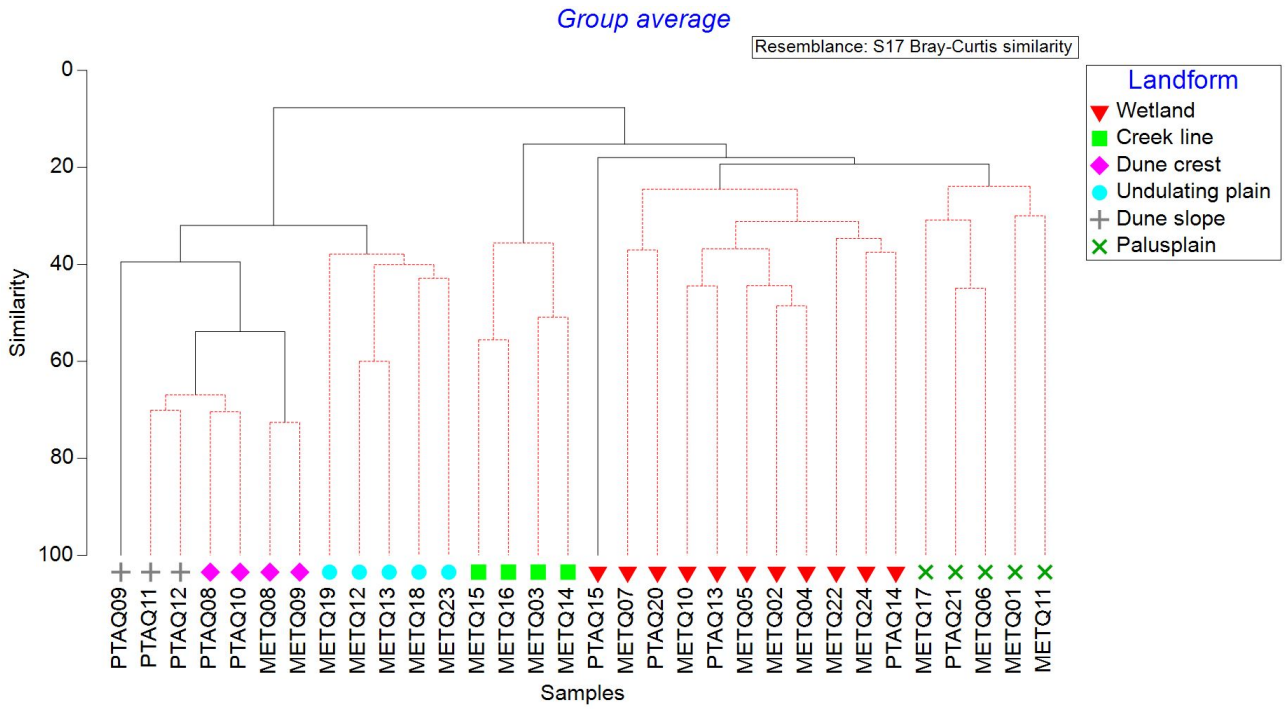
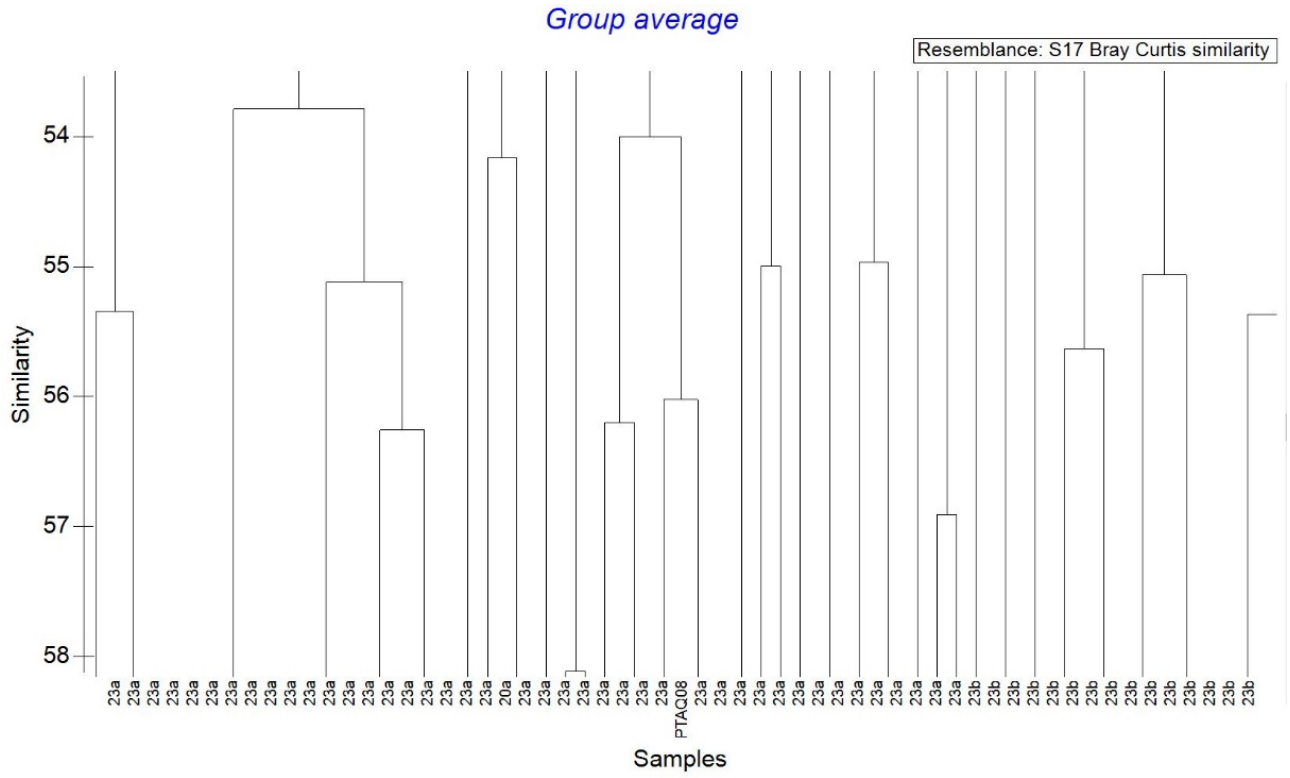
Appendix H

Hierarchical cluster analyses

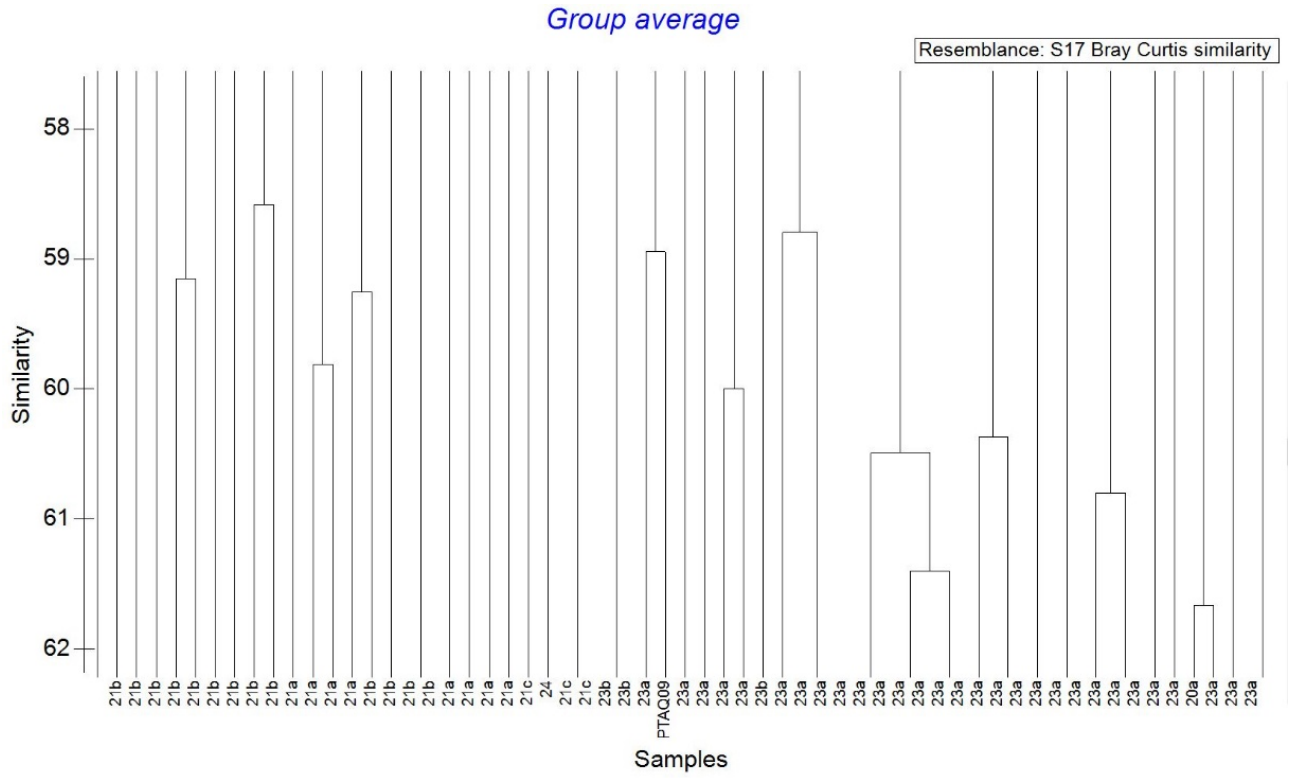
APPENDIX H: HIERARCHICAL CLUSTER ANALYSIS DENDROGRAMS



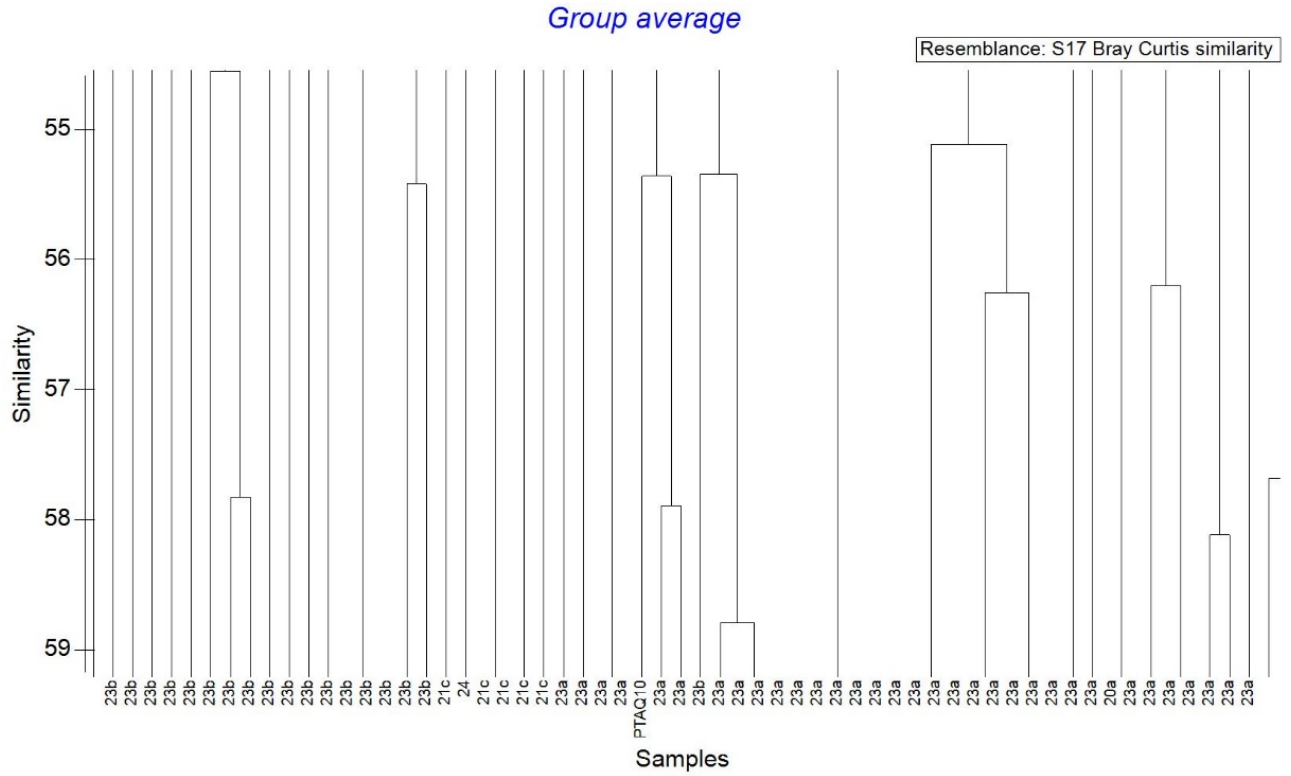
Graph H-1 Classification dendrogram showing grouping of survey quadrats by landform. The cluster analysis demonstrates how well correlated floristics are to landform with sites on each landform almost always forming statistically significant groups



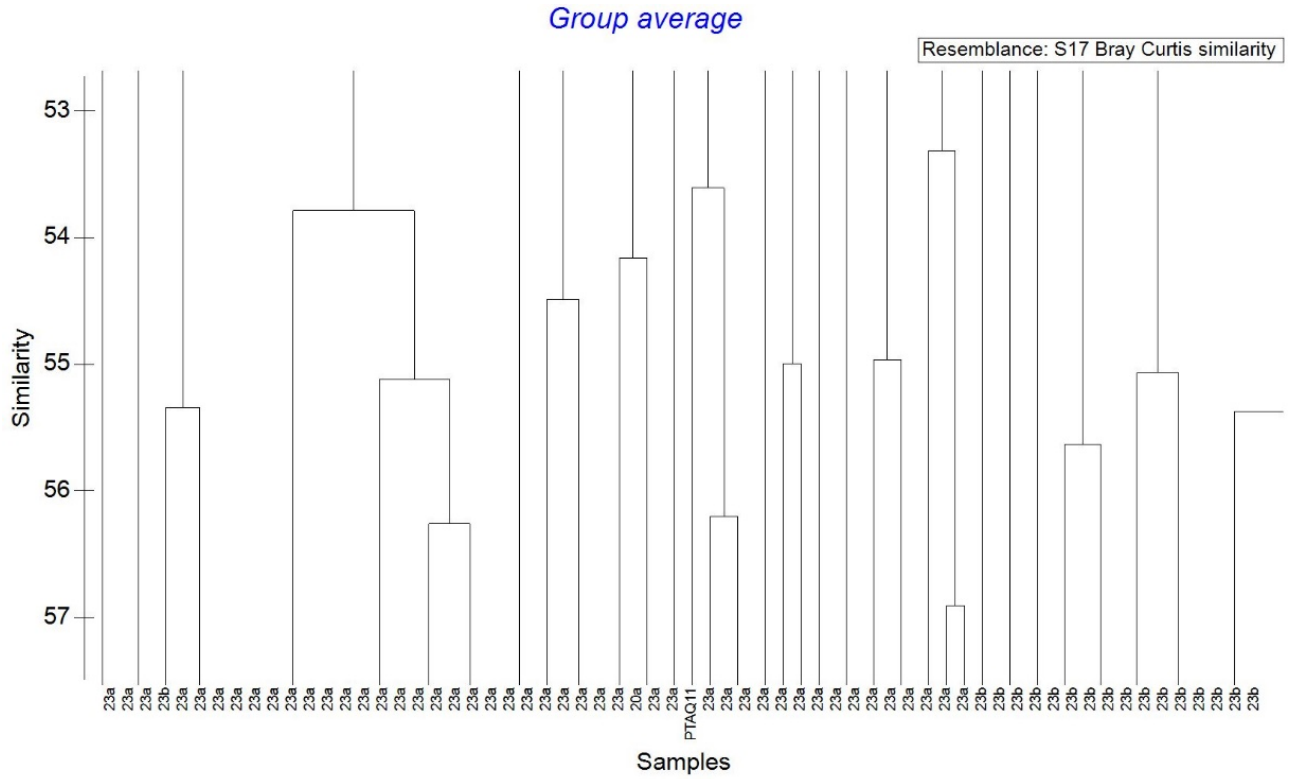
Graph H-2 Relevant portion of classification dendrogram showing relationship between PTAQ08 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT23a



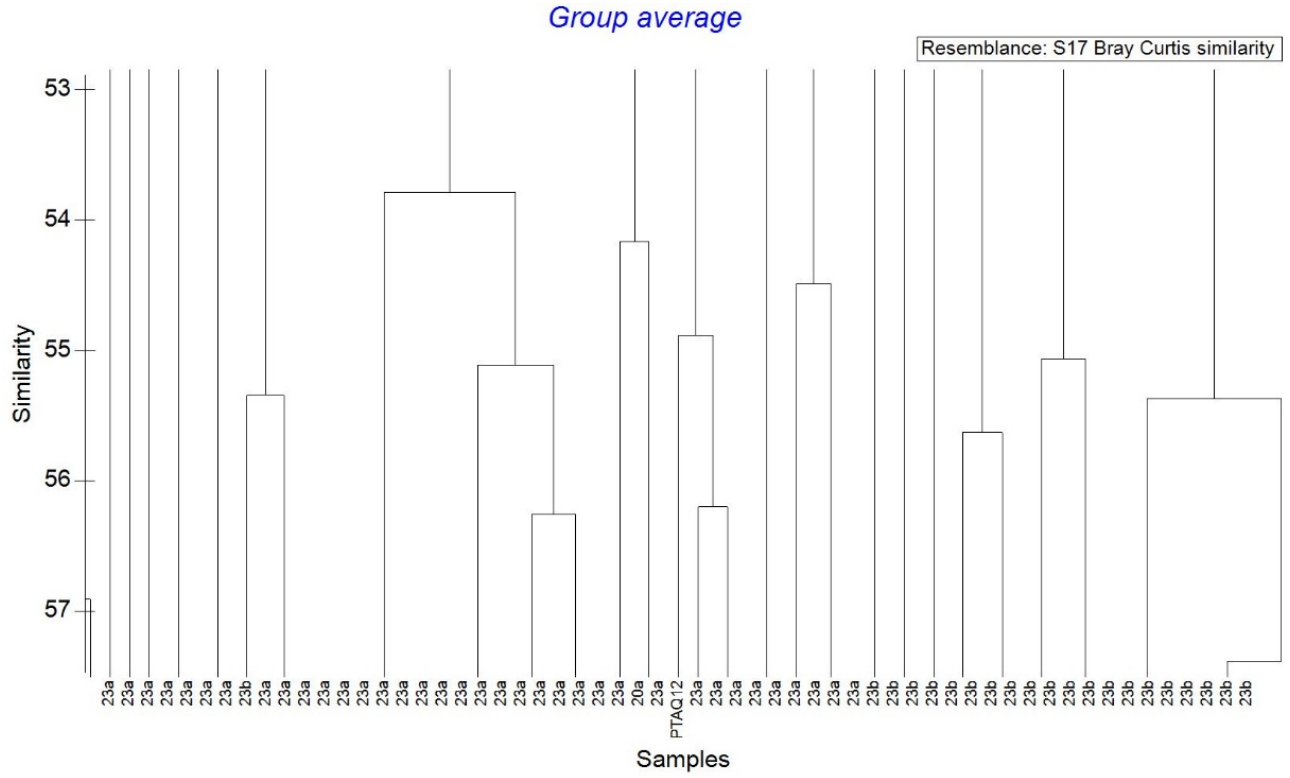
Graph H-3 Relevant portion of classification dendrogram showing relationship between PTAQ09 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT23a / FCT23b



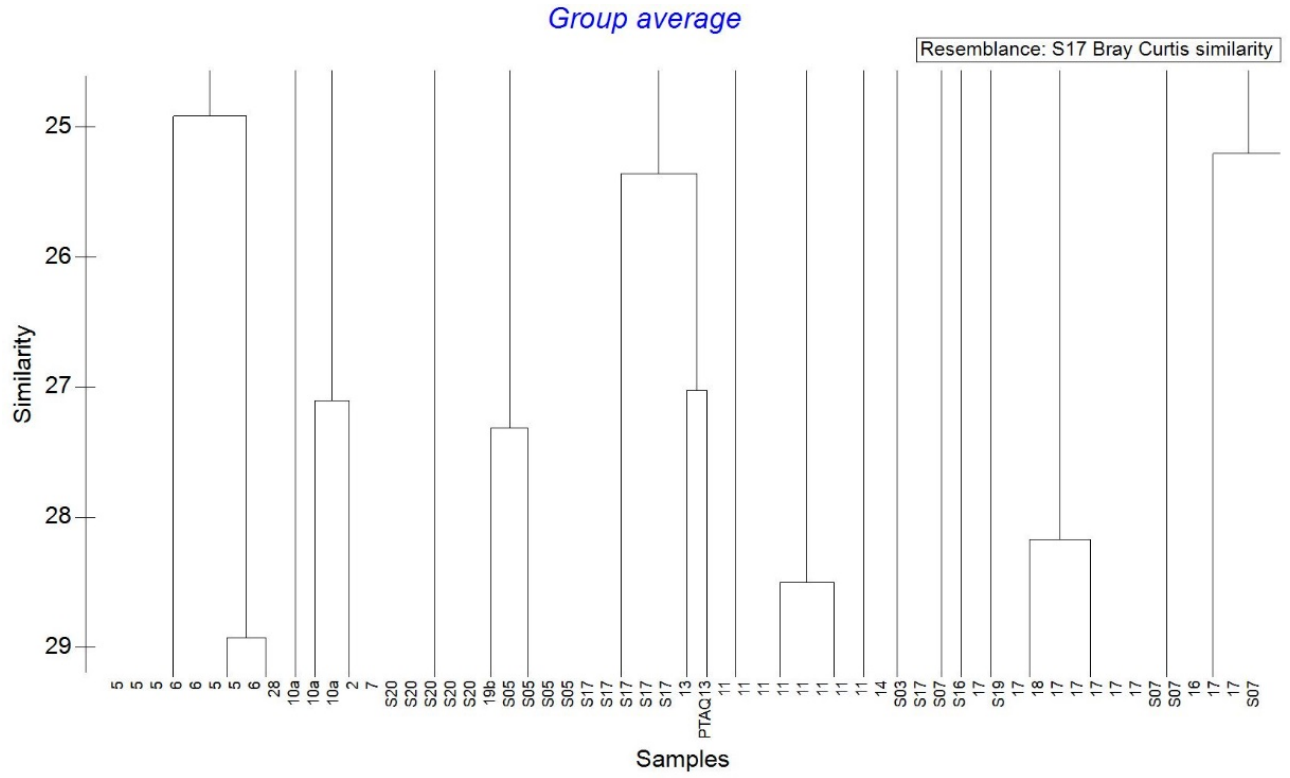
Graph H-4 Relevant portion of classification dendrogram showing relationship between PTAQ10 and combined SCP and supplementary dataset (Keighery et al. 2012) - Fct23a



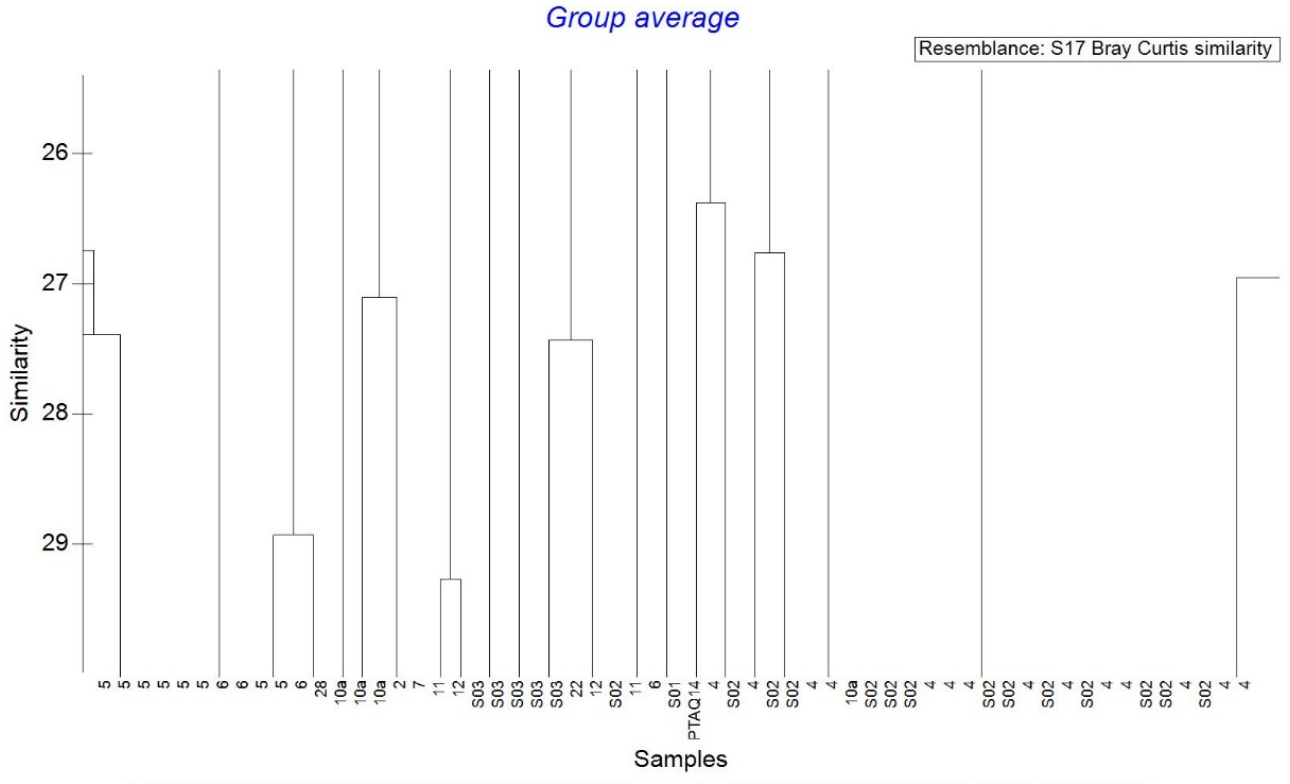
Graph H-5 Relevant portion of classification dendrogram showing relationship between PTAQ11 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT23a



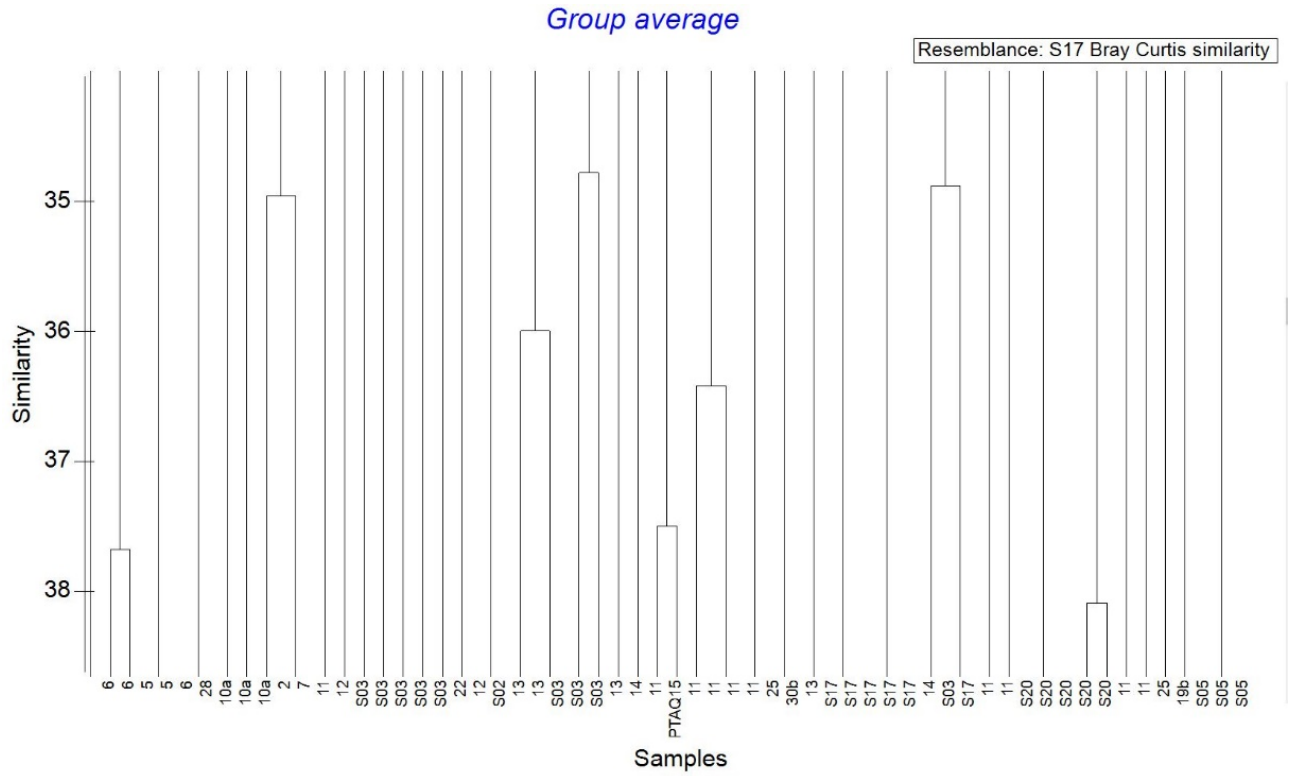
Graph H-6 Relevant portion of classification dendrogram showing relationship between PTAQ12 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT23a



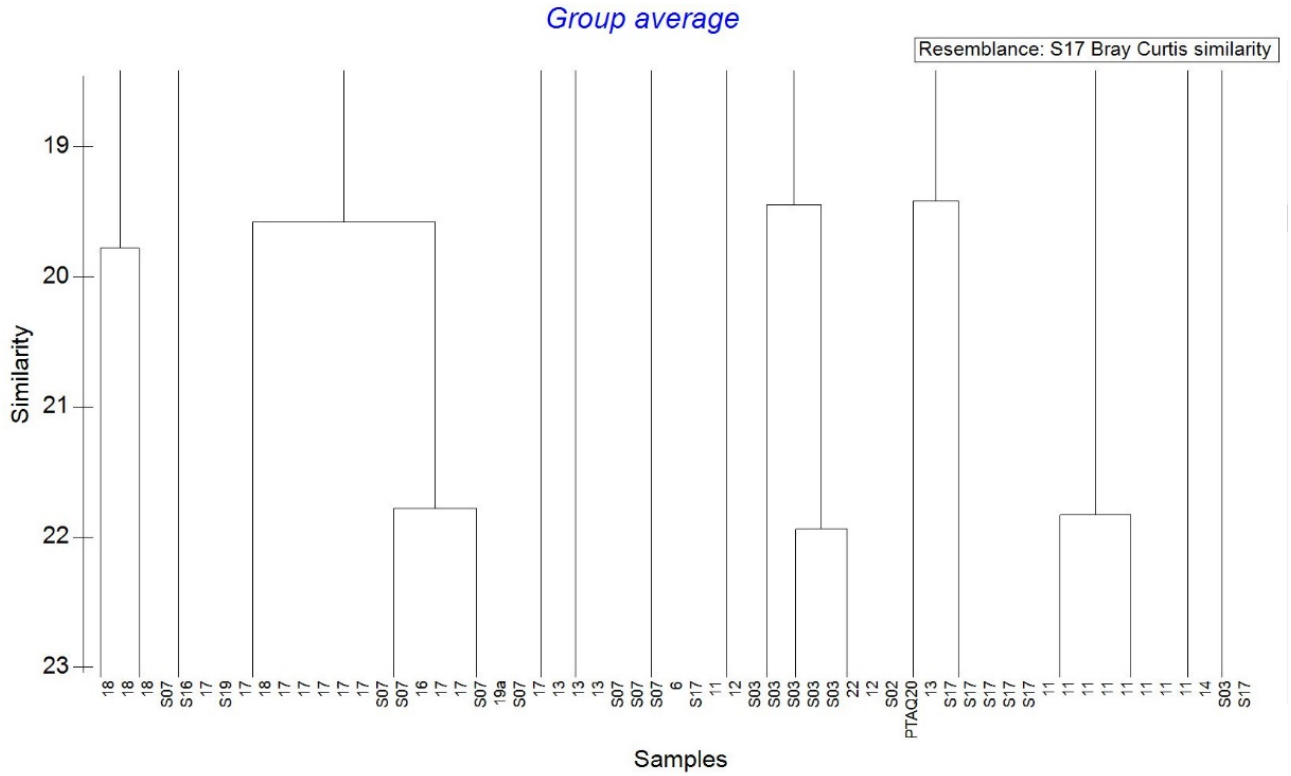
Graph H-7 Relevant portion of classification dendrogram showing relationship between PTAQ13 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCTS17



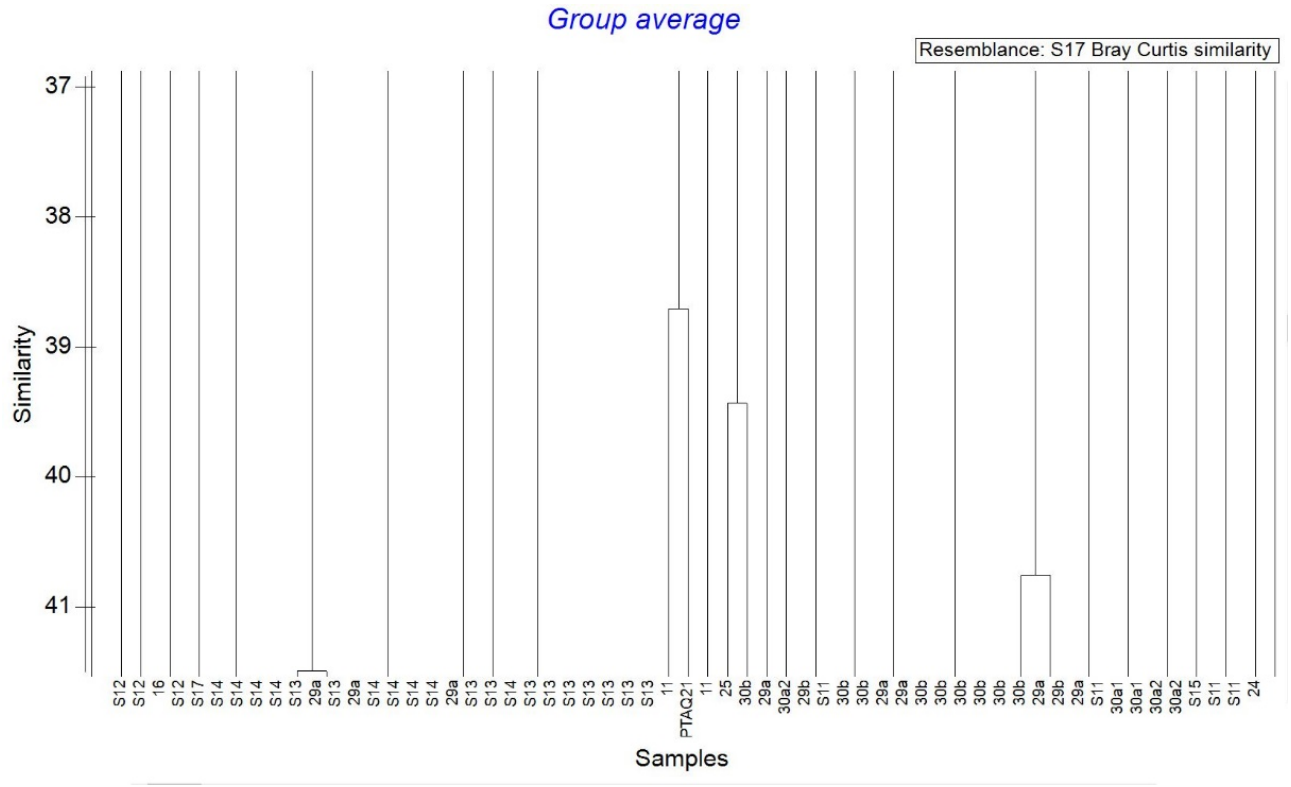
Graph H-8 Relevant portion of classification dendrogram showing relationship between PTAQ14 and combined SCP and supplementary dataset (Keighery et al. 2012)



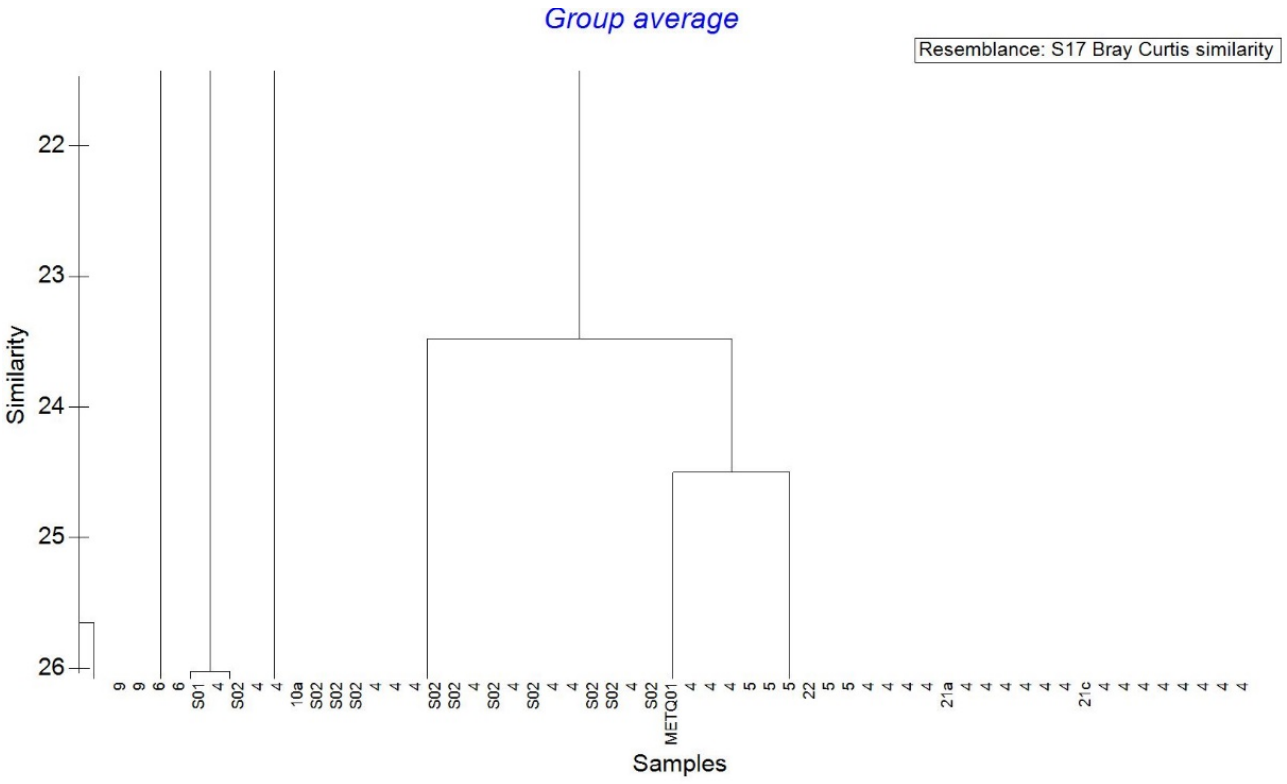
Graph H-9 Relevant portion of classification dendrogram showing relationship between PTAQ15 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT11



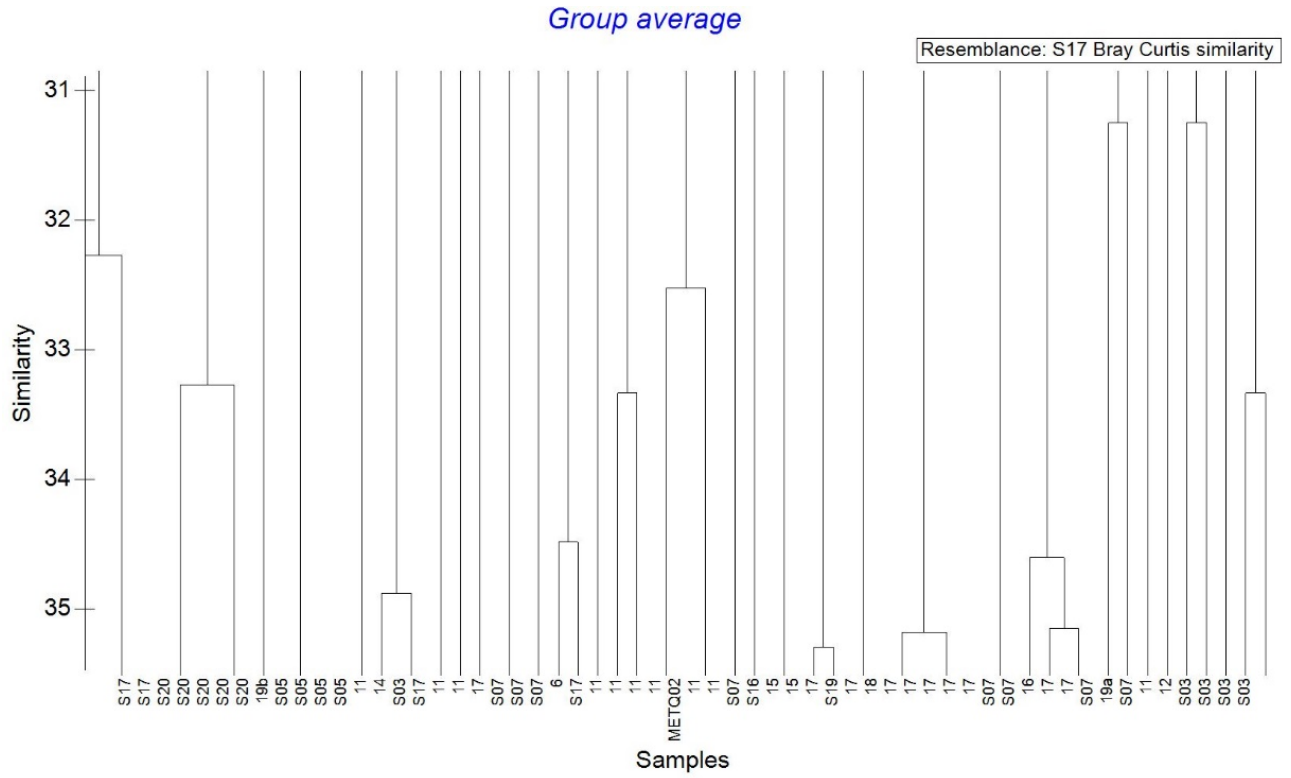
Graph H-10 Relevant portion of classification dendrogram showing relationship between PTAQ20 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCTS17



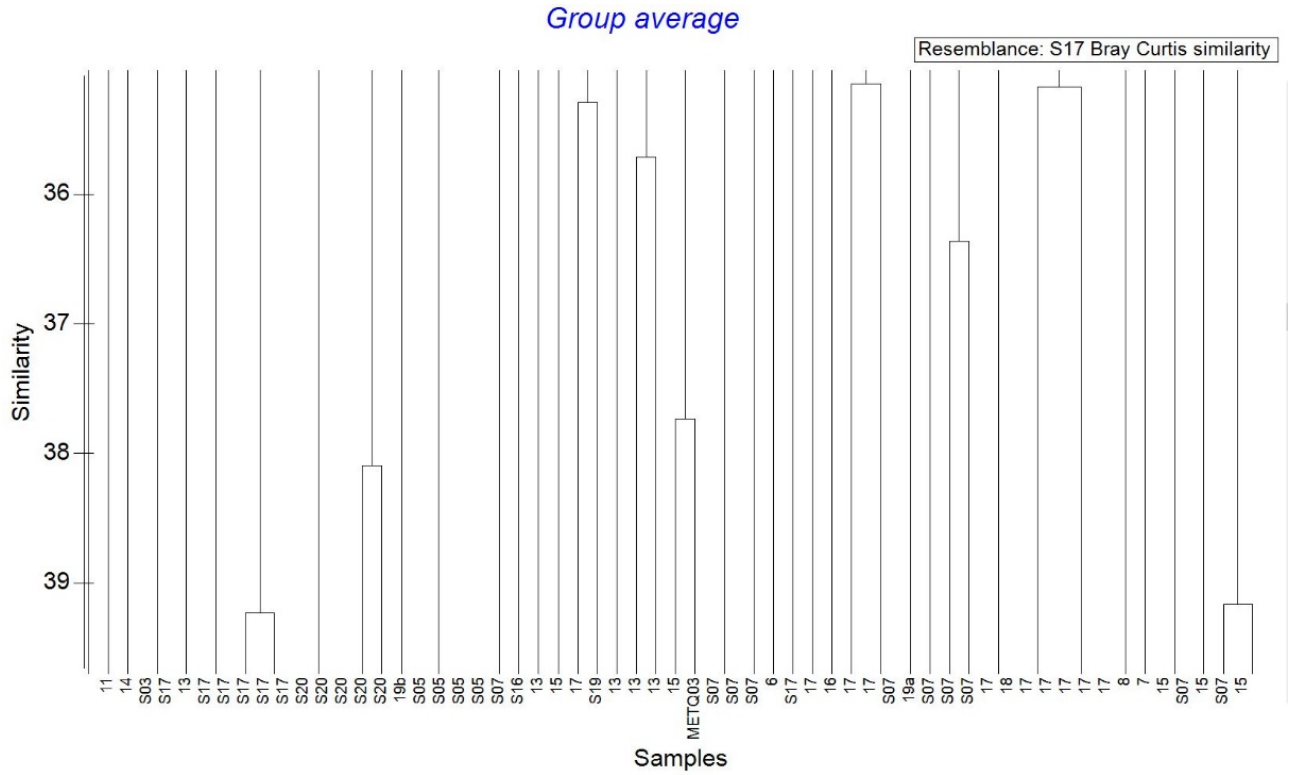
Graph H-11 Relevant portion of classification dendrogram showing relationship between PTAQ21 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT11



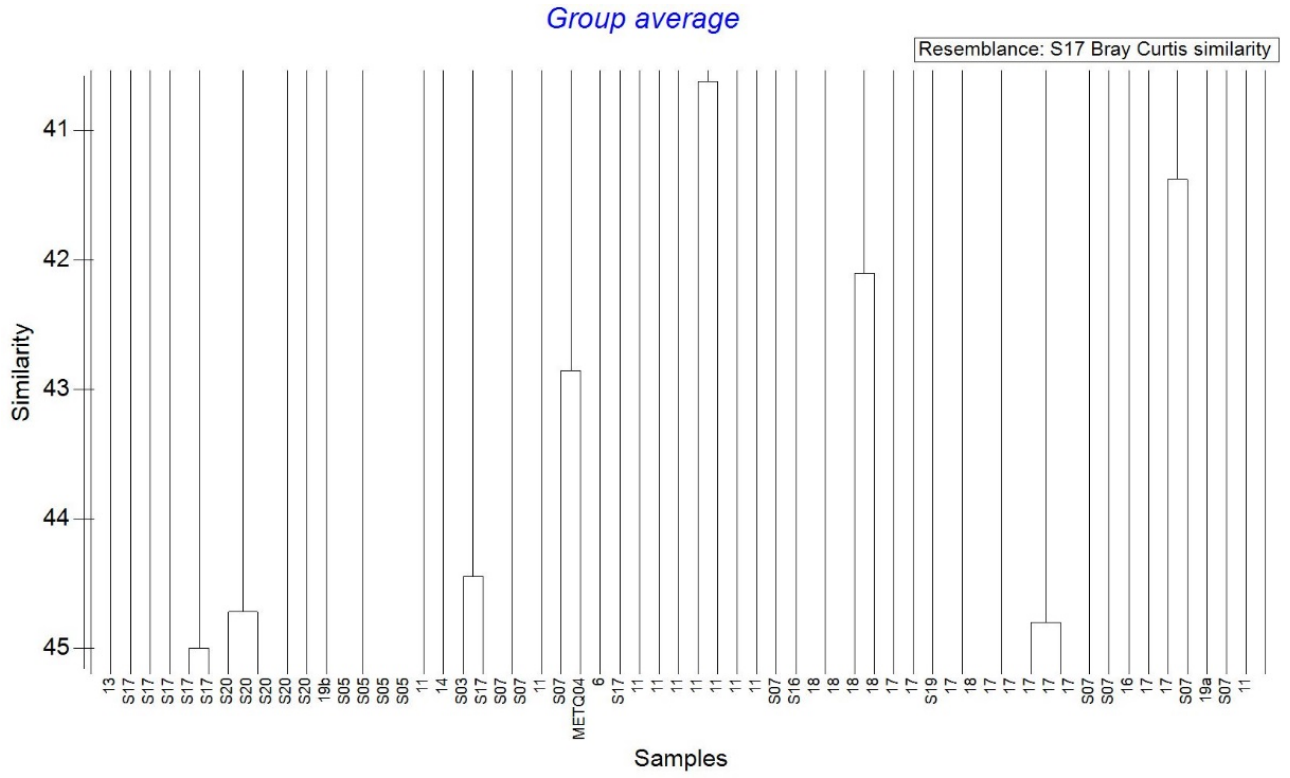
Graph H-12 Relevant portion of classification dendrogram showing relationship between METQ01 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT04



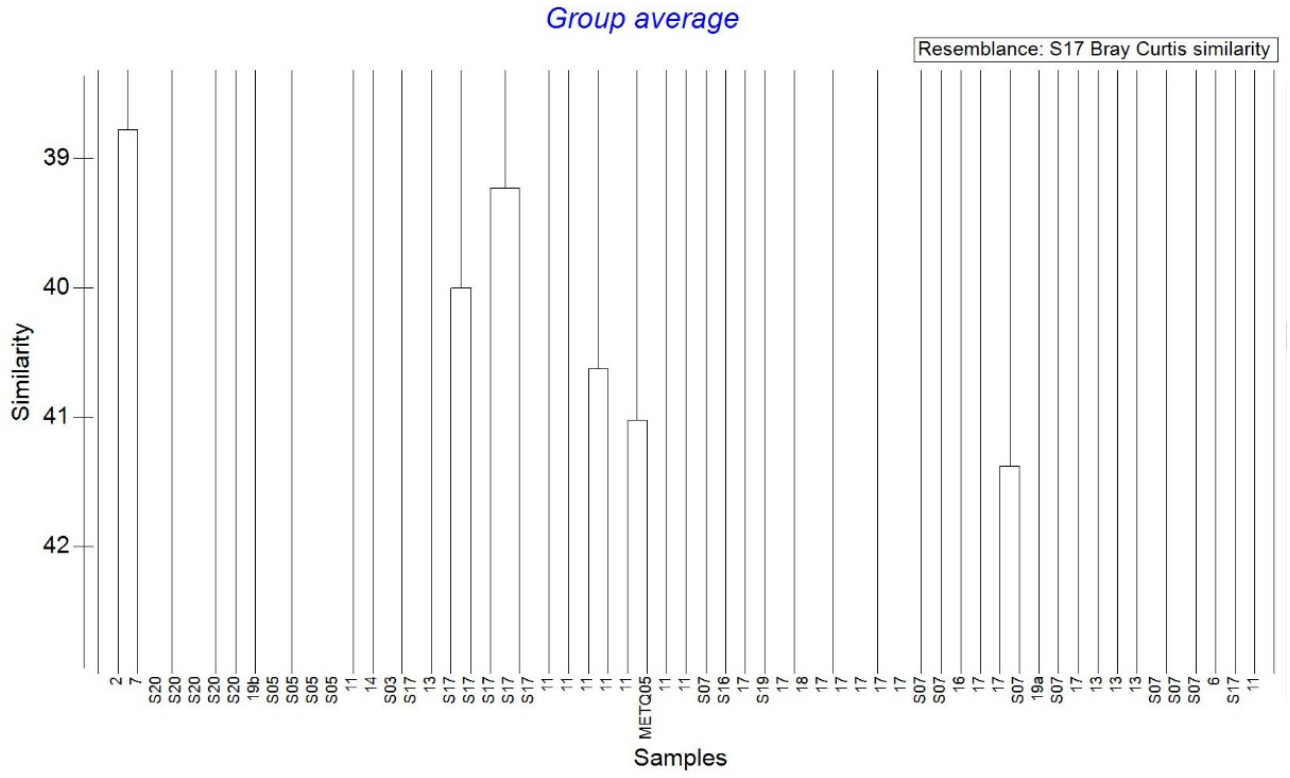
Graph H-13 Relevant portion of classification dendrogram showing relationship between METQ02 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT11



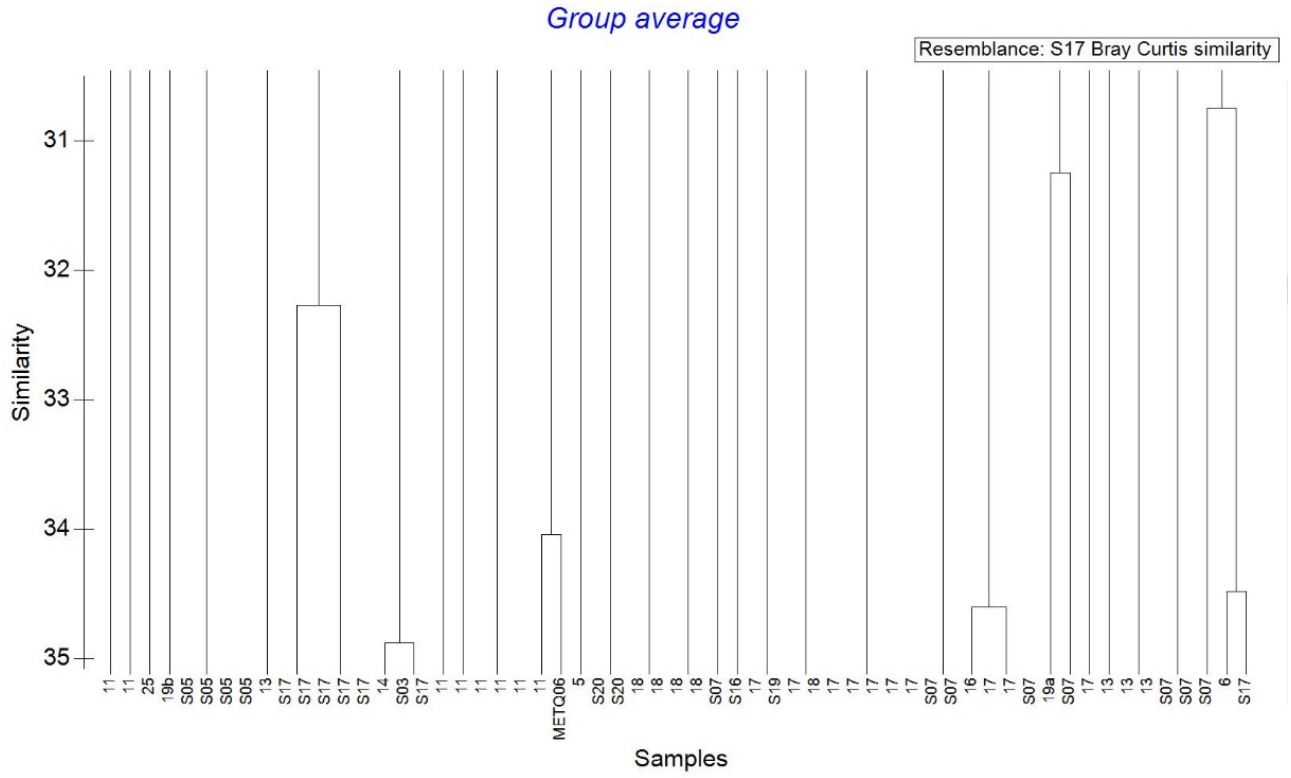
Graph H-14 Relevant portion of classification dendrogram showing relationship between METQ03 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT15



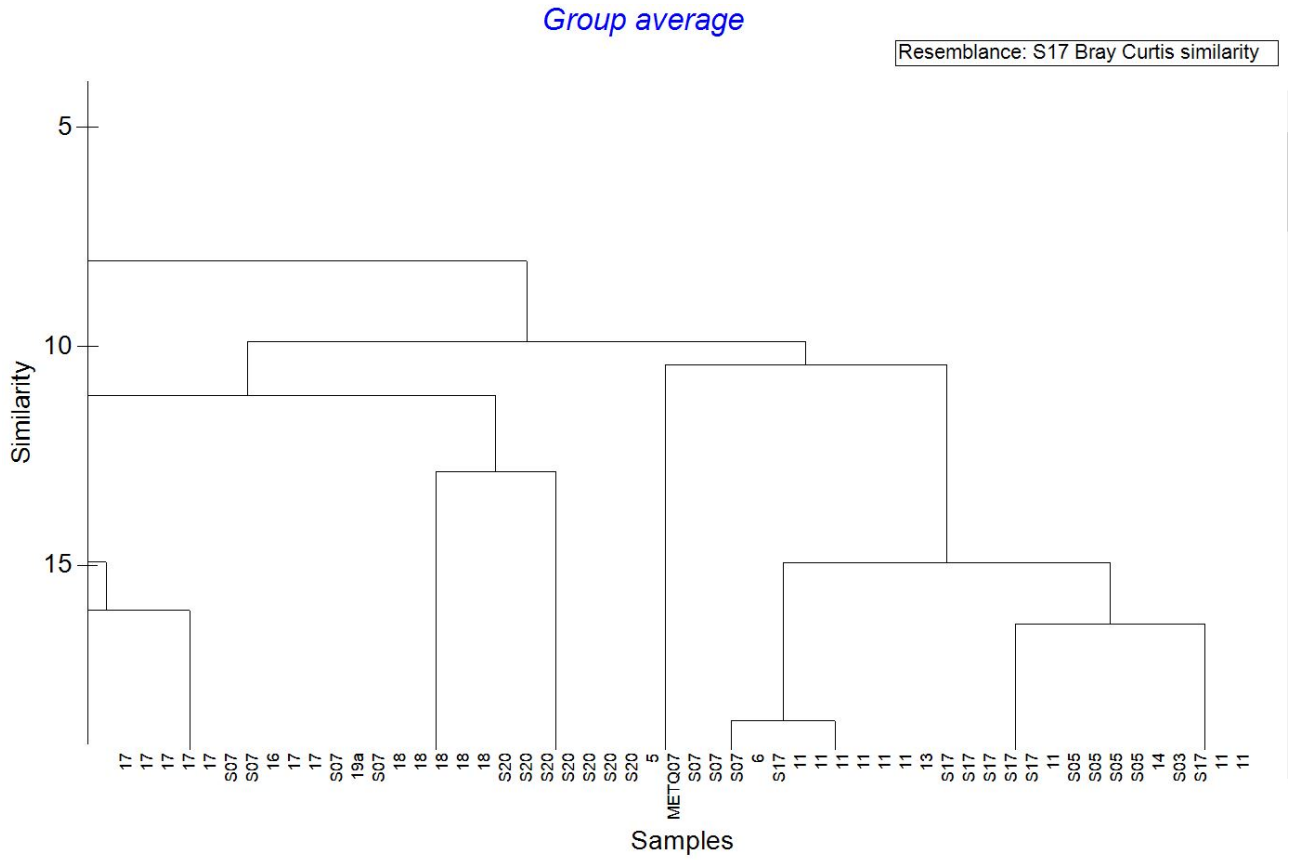
Graph H-15 Relevant portion of classification dendrogram showing relationship between METQ04 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCTS07



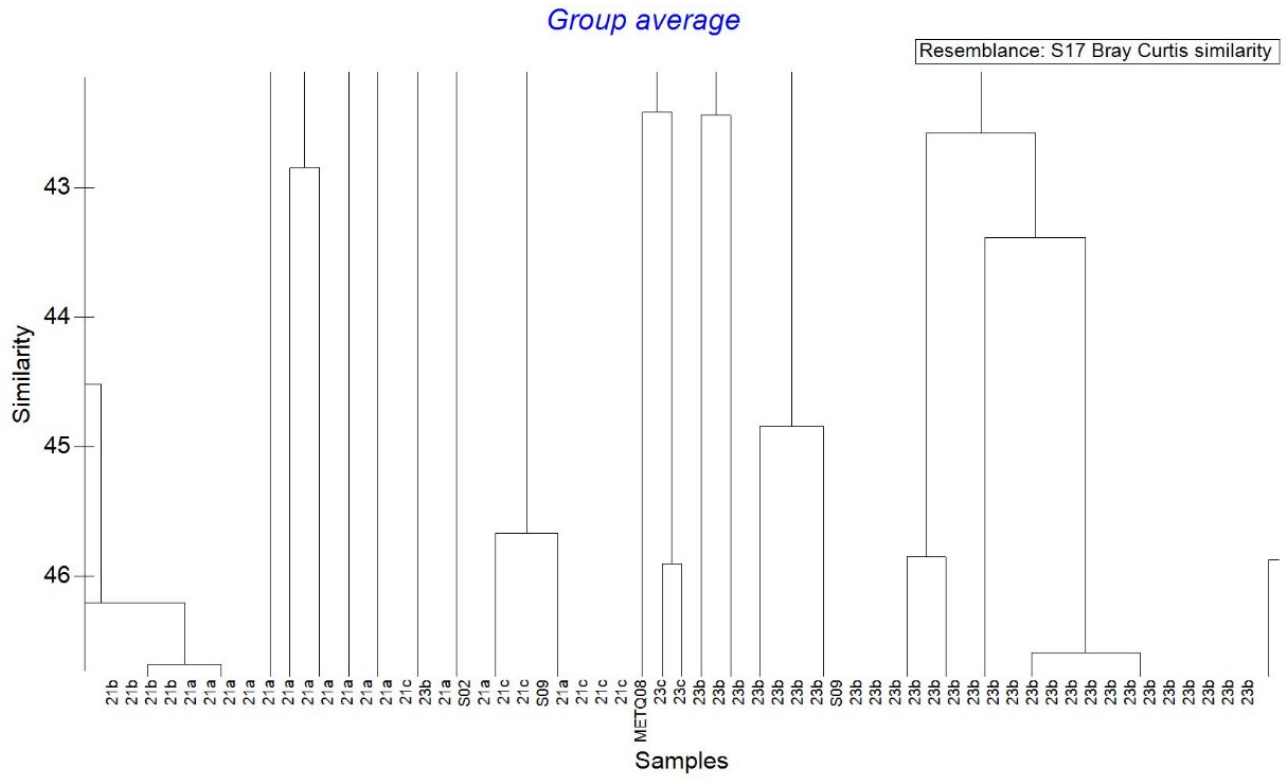
Graph H-16 Relevant portion of classification dendrogram showing relationship between METQ05 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT11



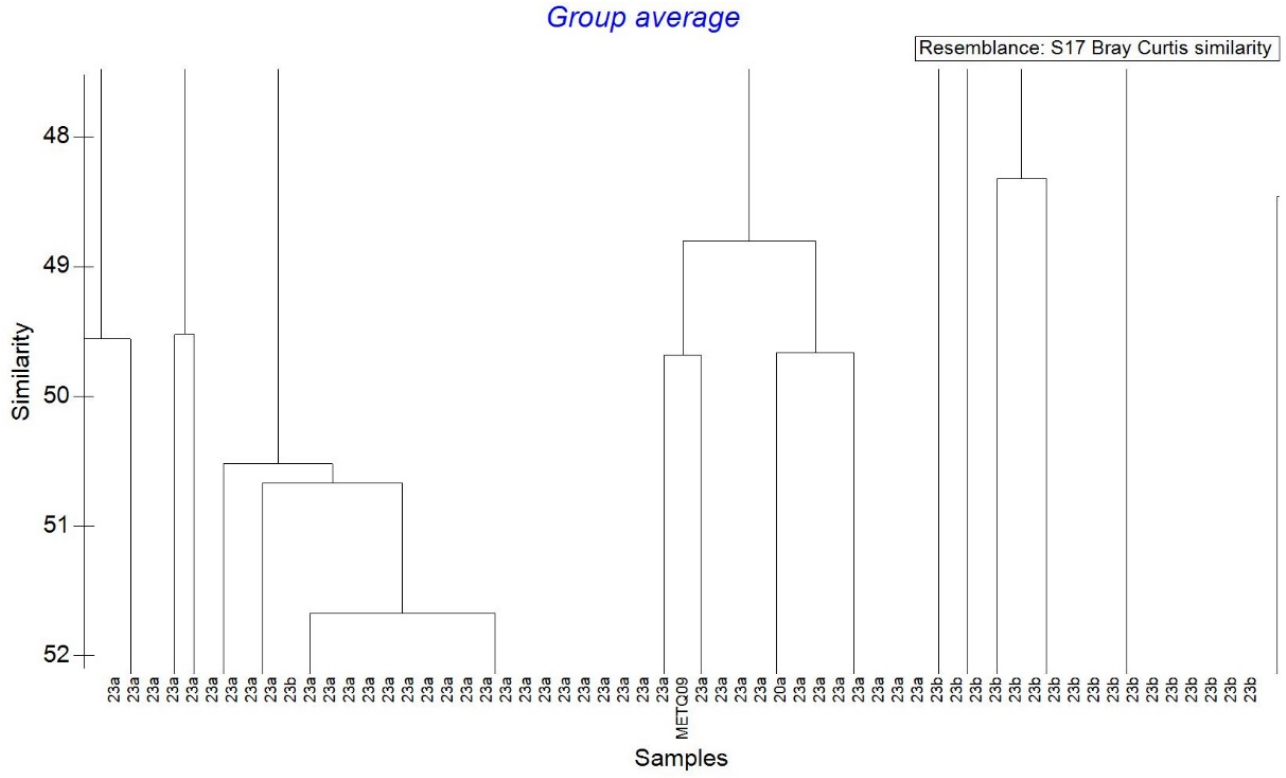
Graph H-17 Relevant portion of classification dendrogram showing relationship between METQ06 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT11



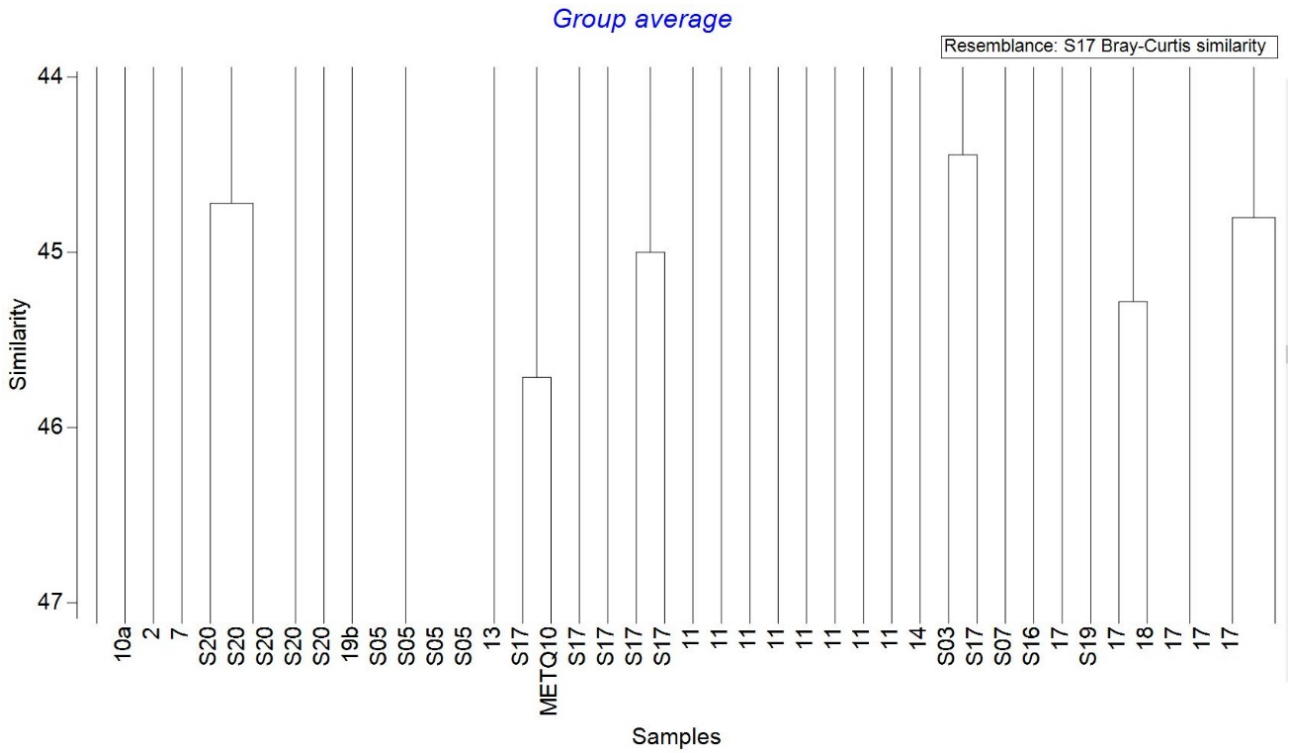
Graph H-18 Relevant portion of classification dendrogram showing relationship between METQ07 and combined SCP and supplementary dataset (Keighery et al. 2012)



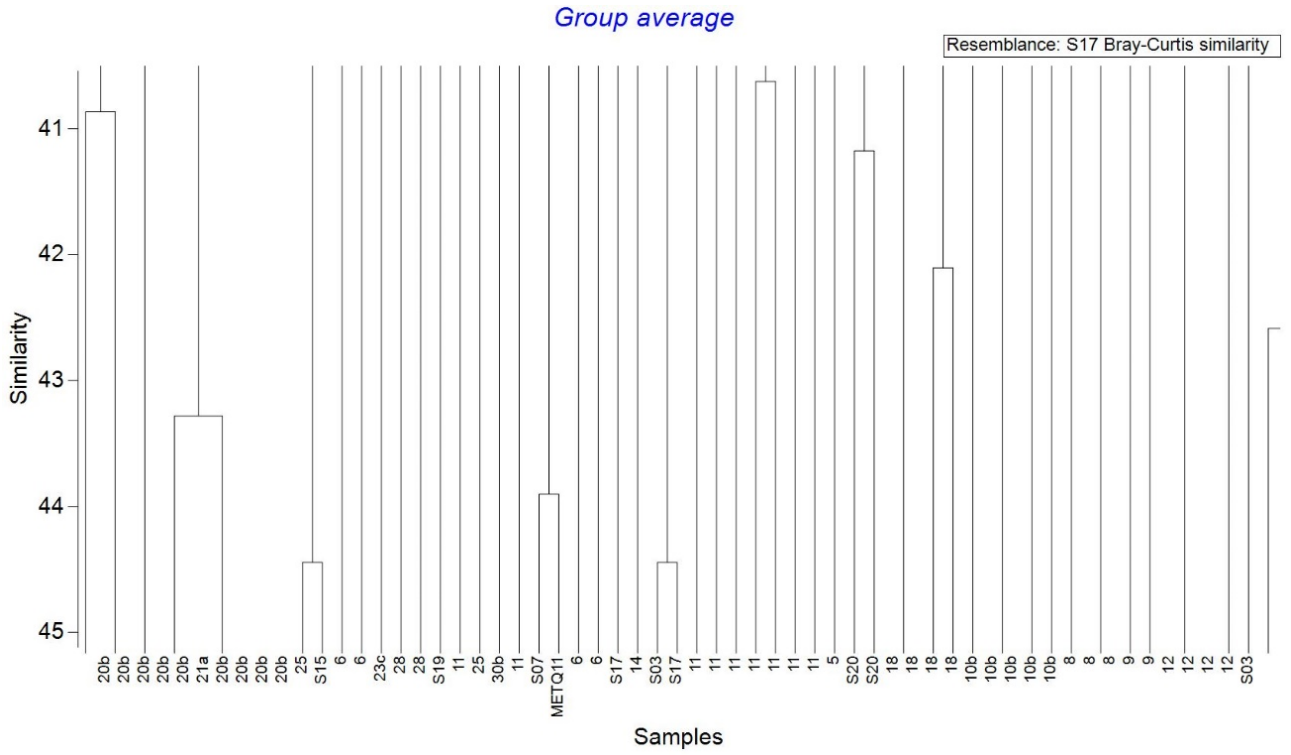
Graph H-19 Relevant portion of classification dendrogram showing relationship between METQ08 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT23c



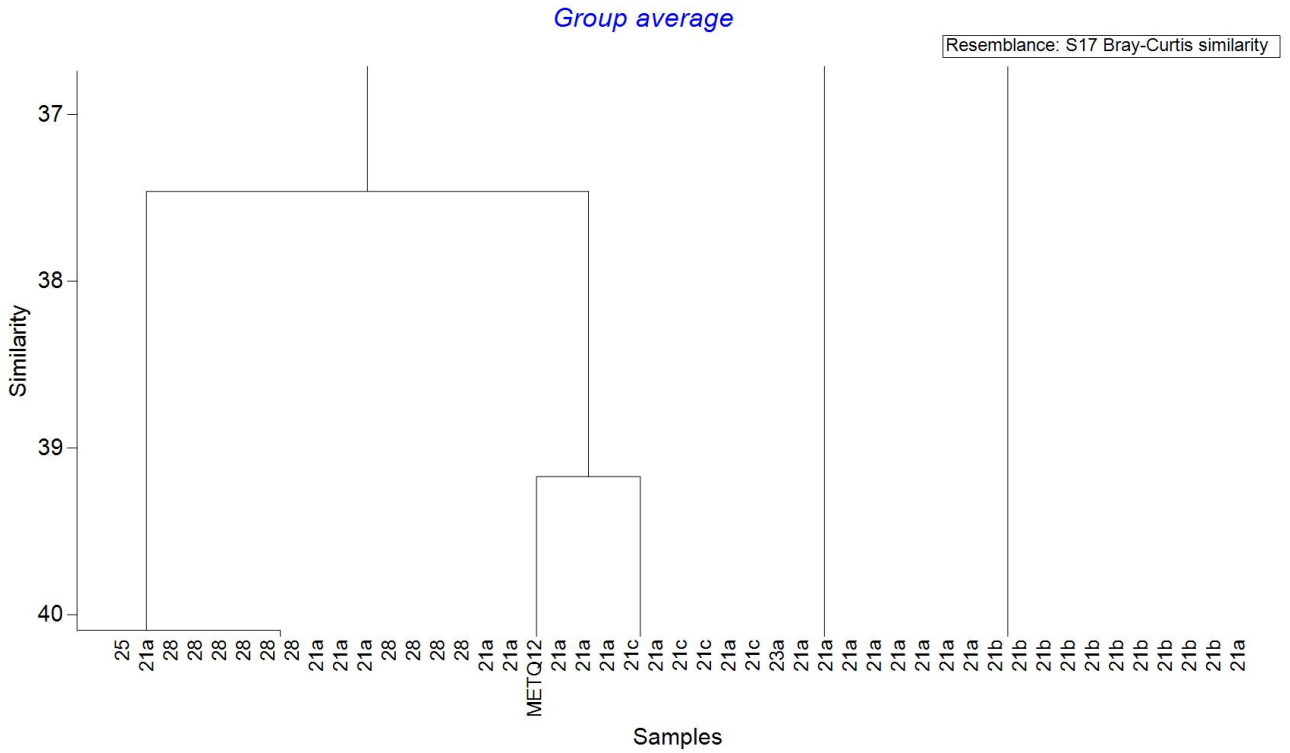
Graph H-20 Relevant portion of classification dendrogram showing relationship between METQ09 and combined SCP and supplementary dataset (Keighery et al. 2012) - FCT23a



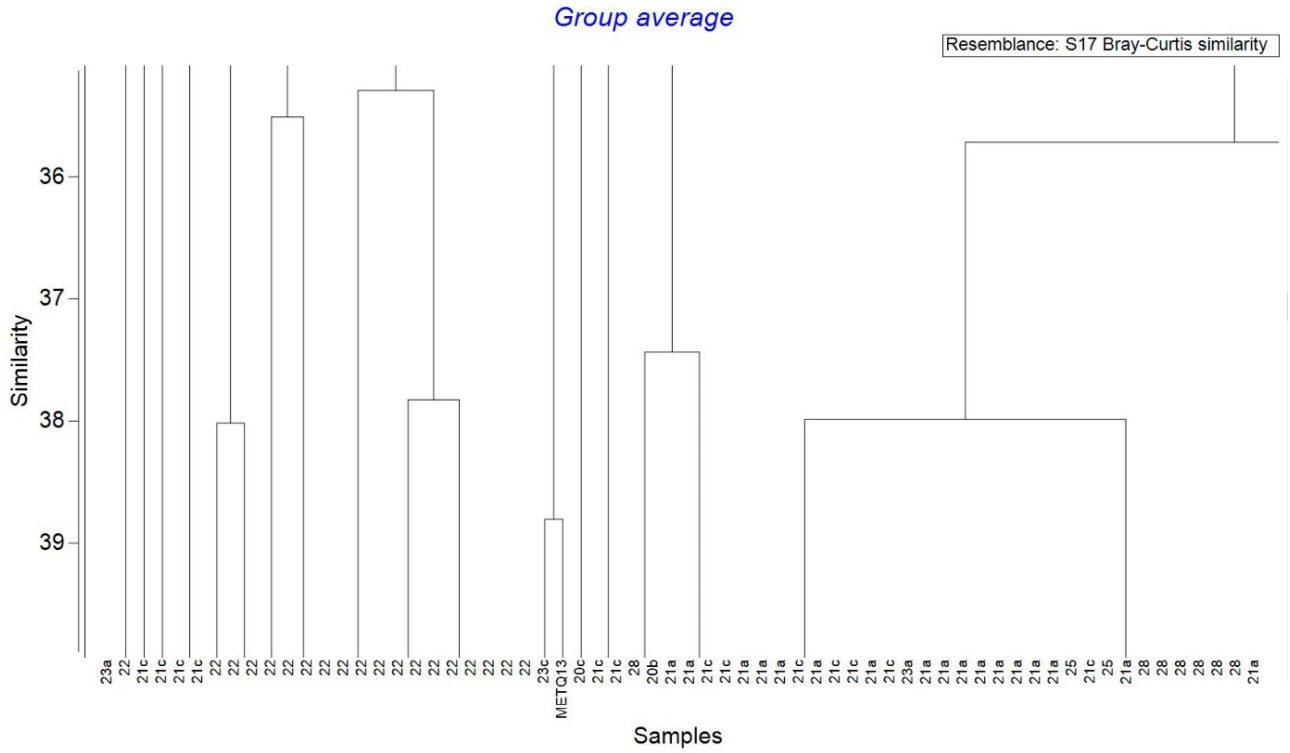
Graph H-21 Relevant portion of classification dendrogram showing relationship between METQ10 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCTS17



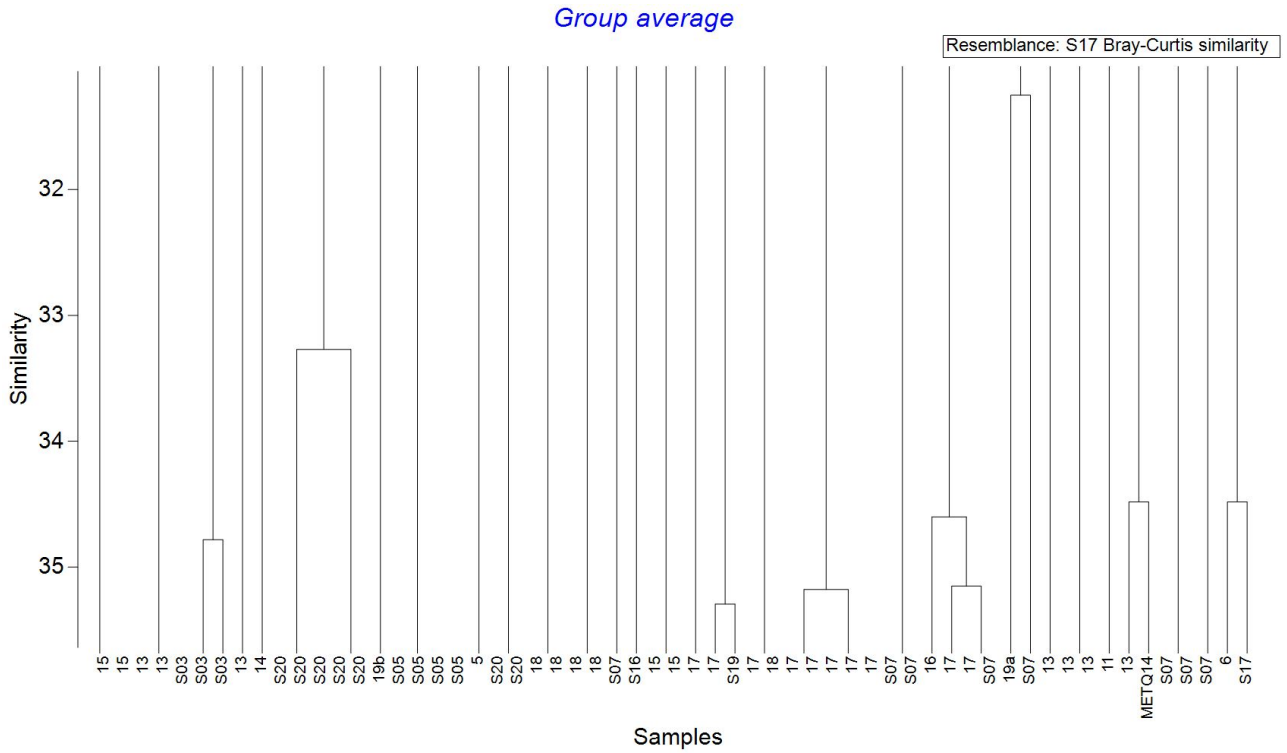
Graph H-22 Relevant portion of classification dendrogram showing relationship between METQ11 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCTS07



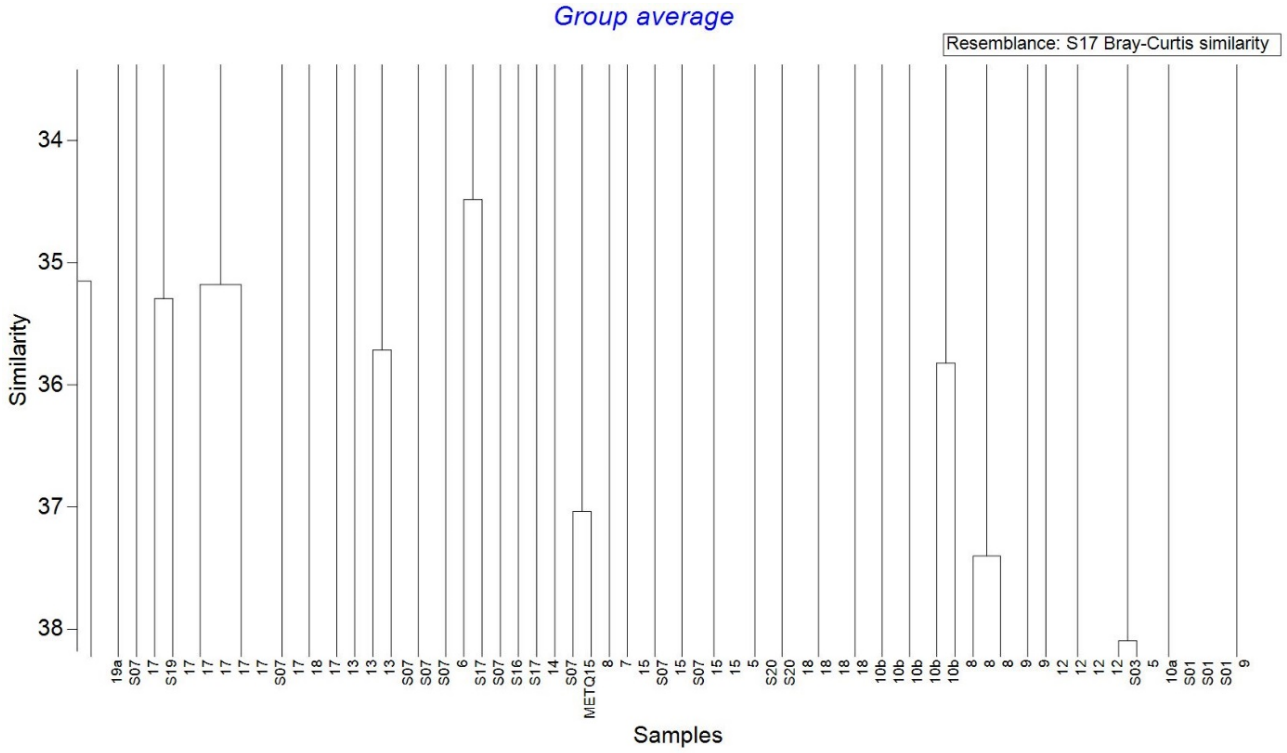
Graph H-23 Relevant portion of classification dendrogram showing relationship between METQ12 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCT21a; FCT21c



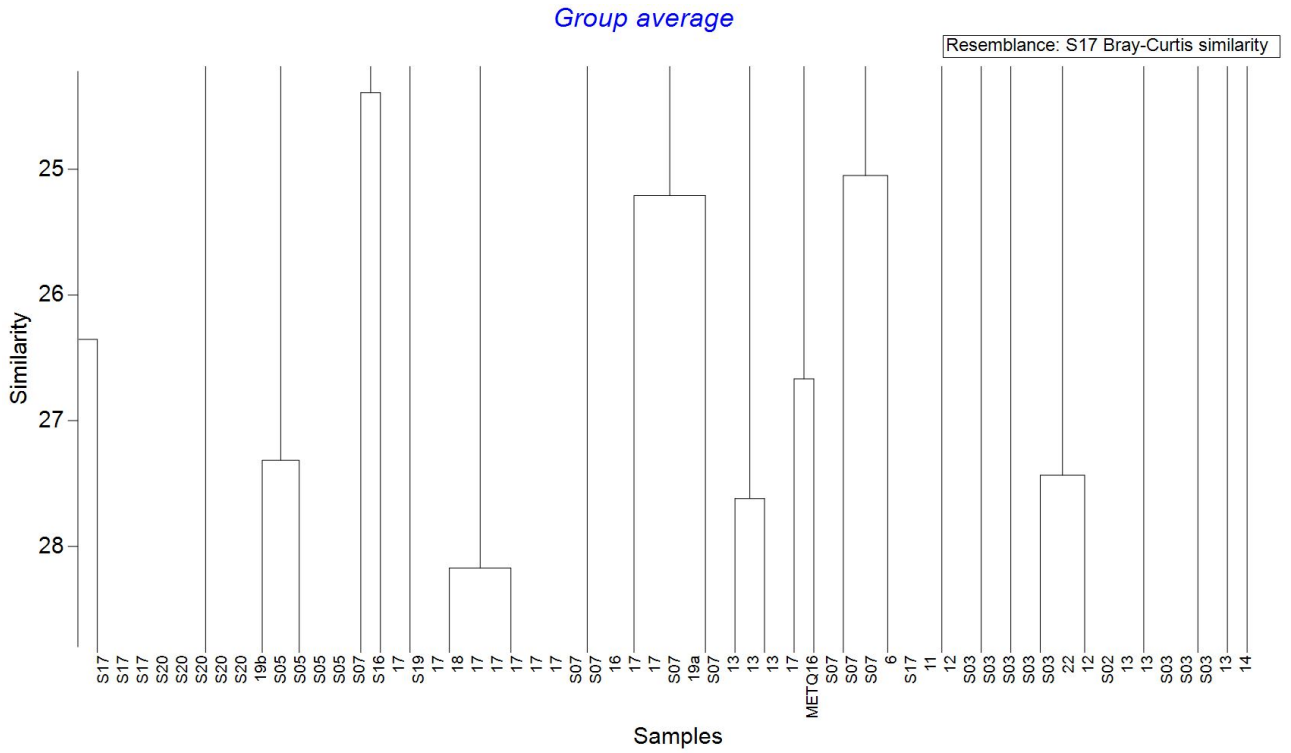
Graph H-24 Relevant portion of classification dendrogram showing relationship between METQ13 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCT23c



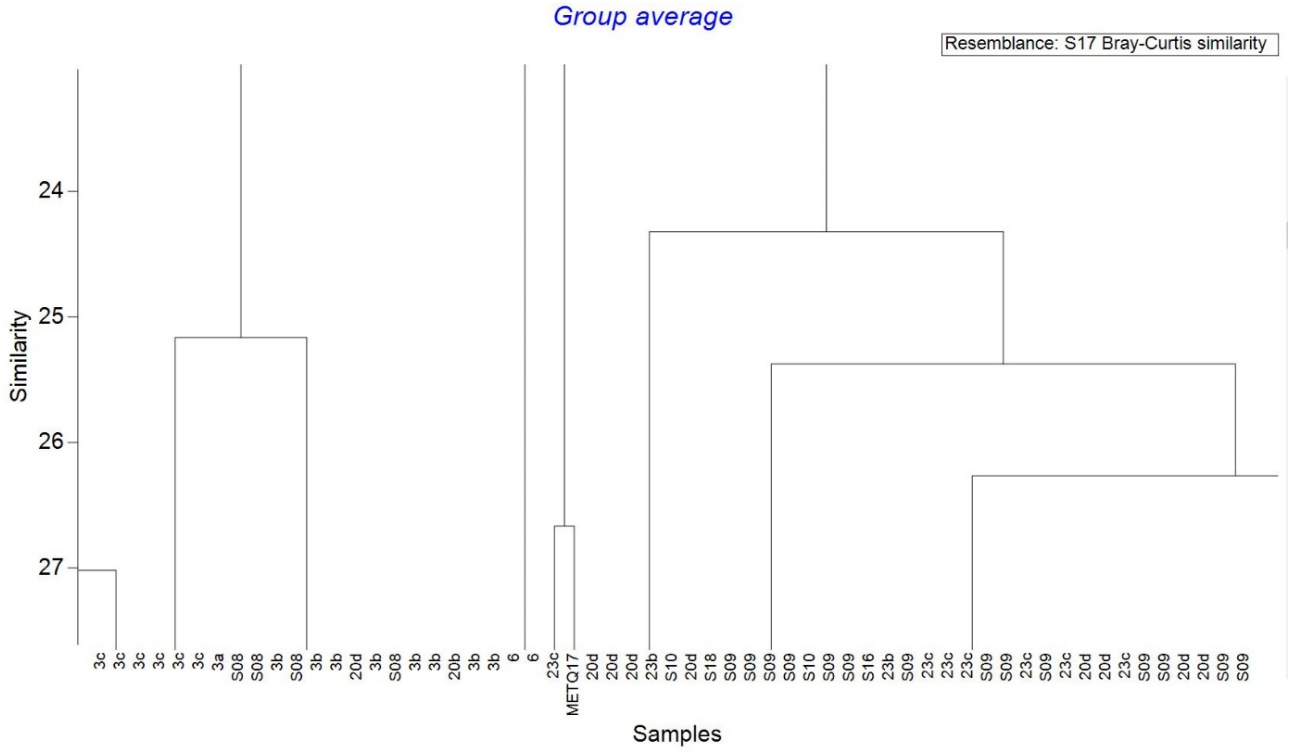
Graph H-25 Relevant portion of classification dendrogram showing relationship between METQ14 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCT13



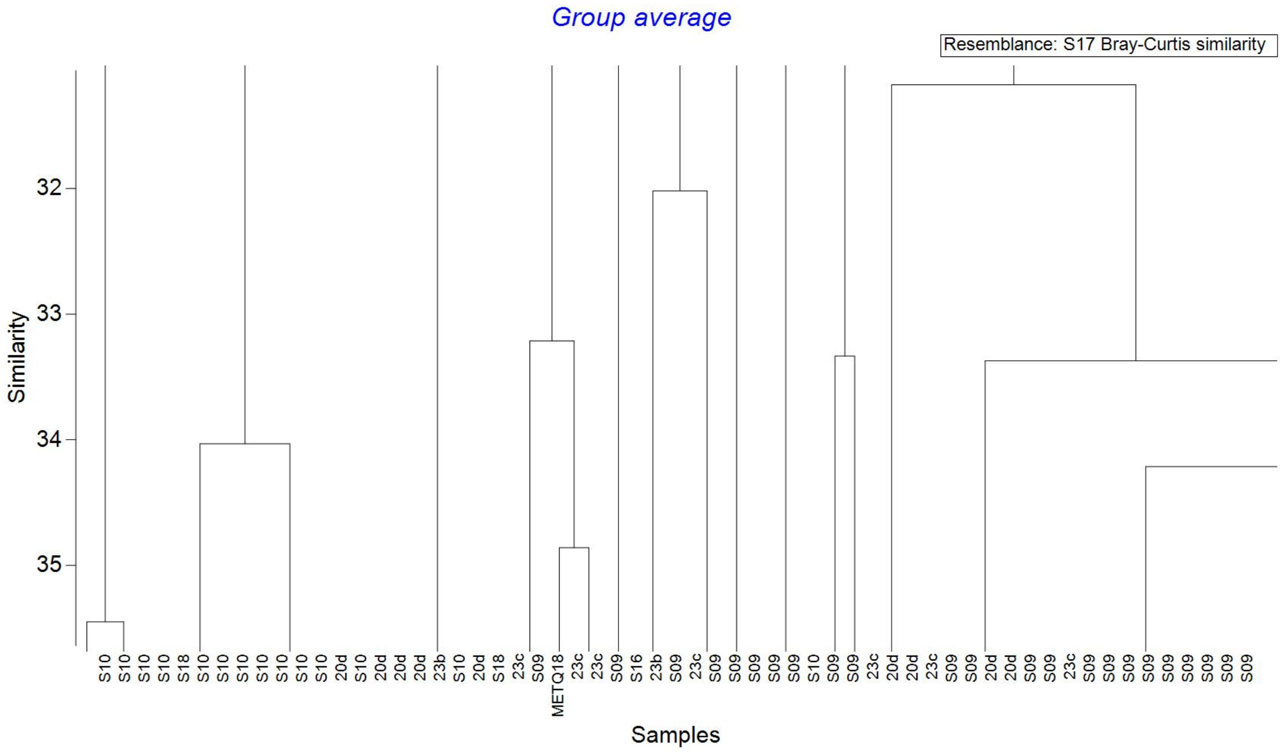
Graph H-26 Relevant portion of classification dendrogram showing relationship between METQ15 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCTS07



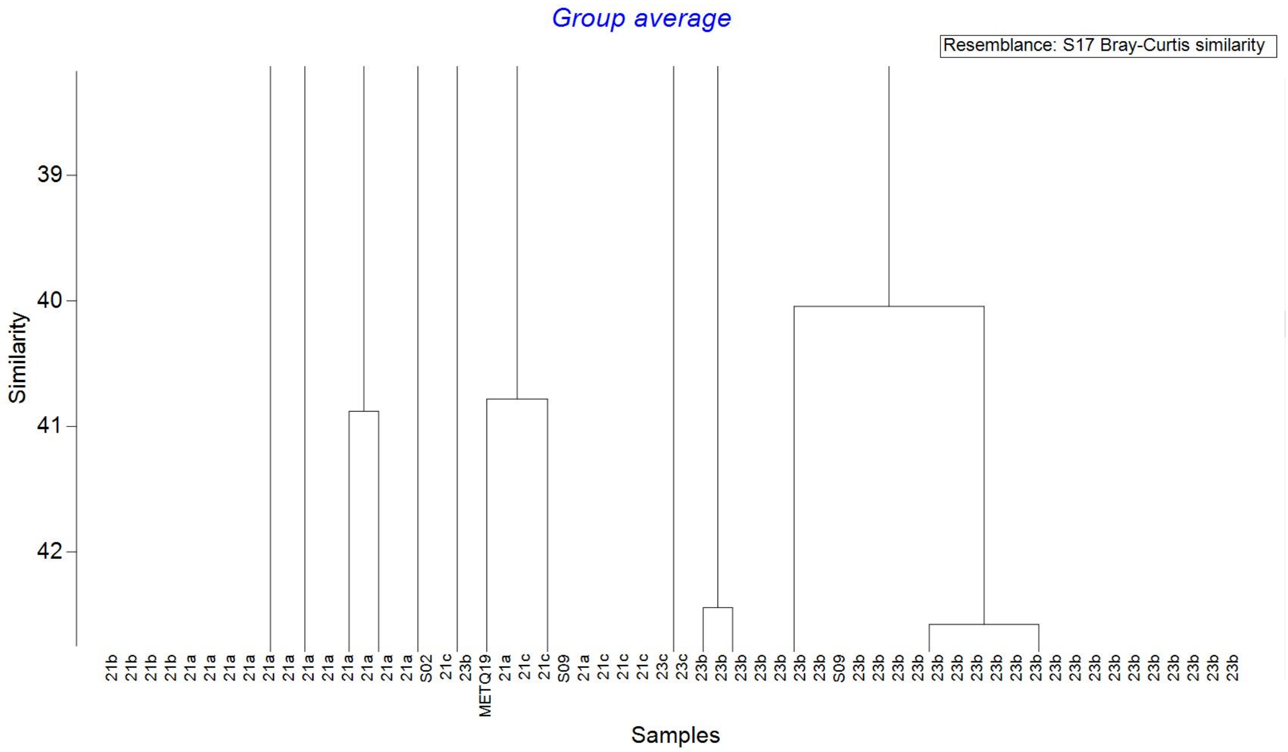
Graph H-27 Relevant portion of classification dendrogram showing relationship between METQ16 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCT17



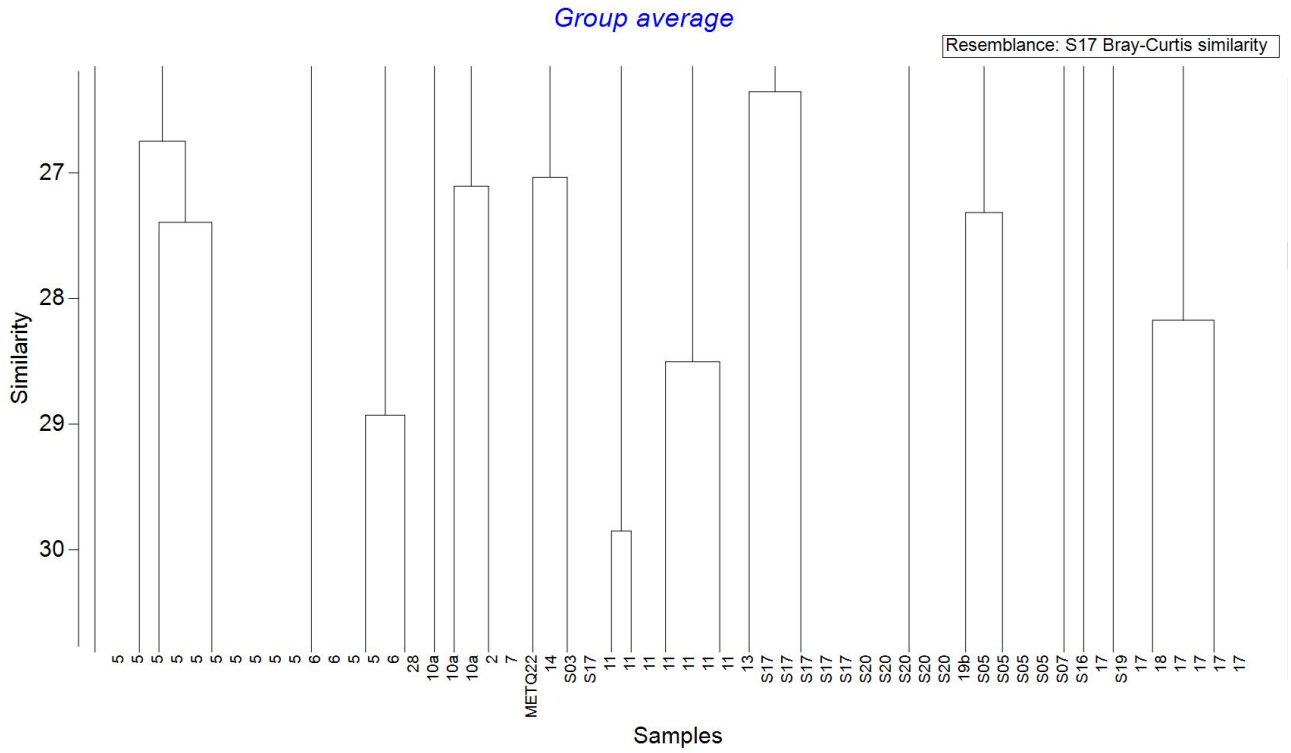
Graph H-28 Relevant portion of classification dendrogram showing relationship between METQ17 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCT23c



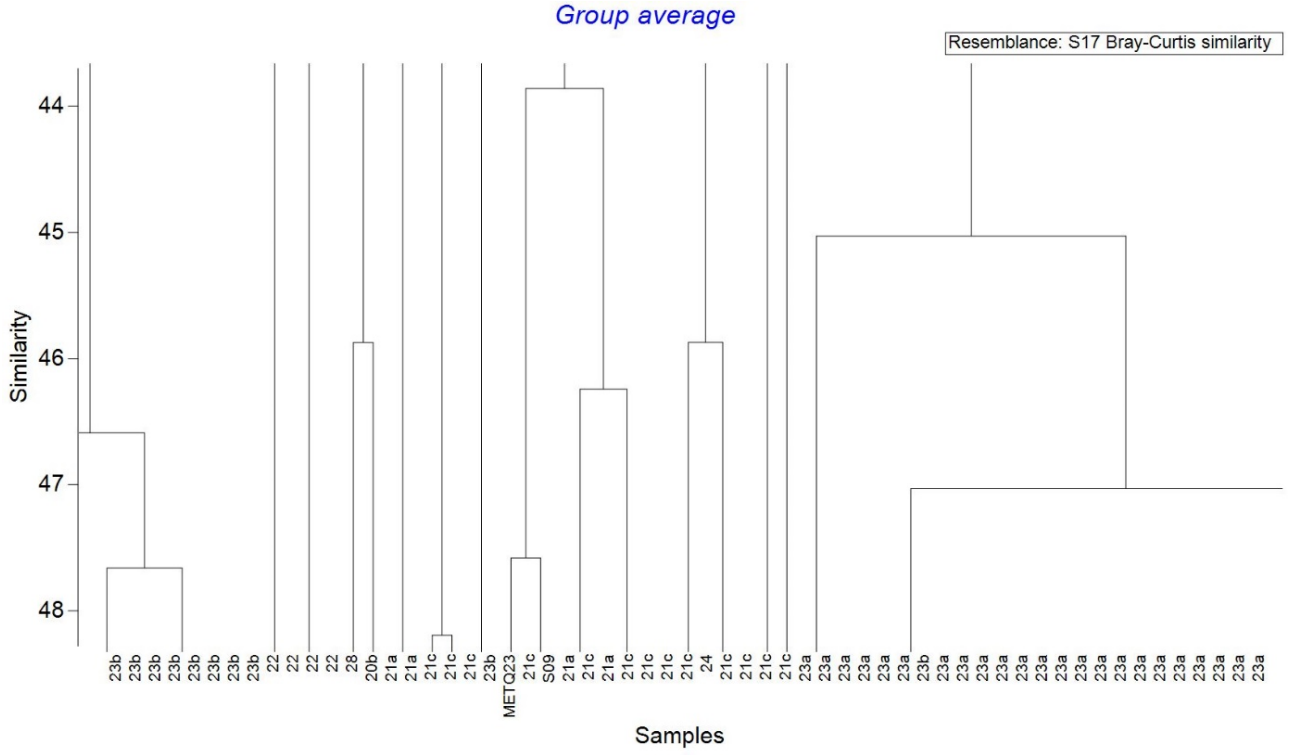
Graph H-29 Relevant portion of classification dendrogram showing relationship between METQ18 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCT23c



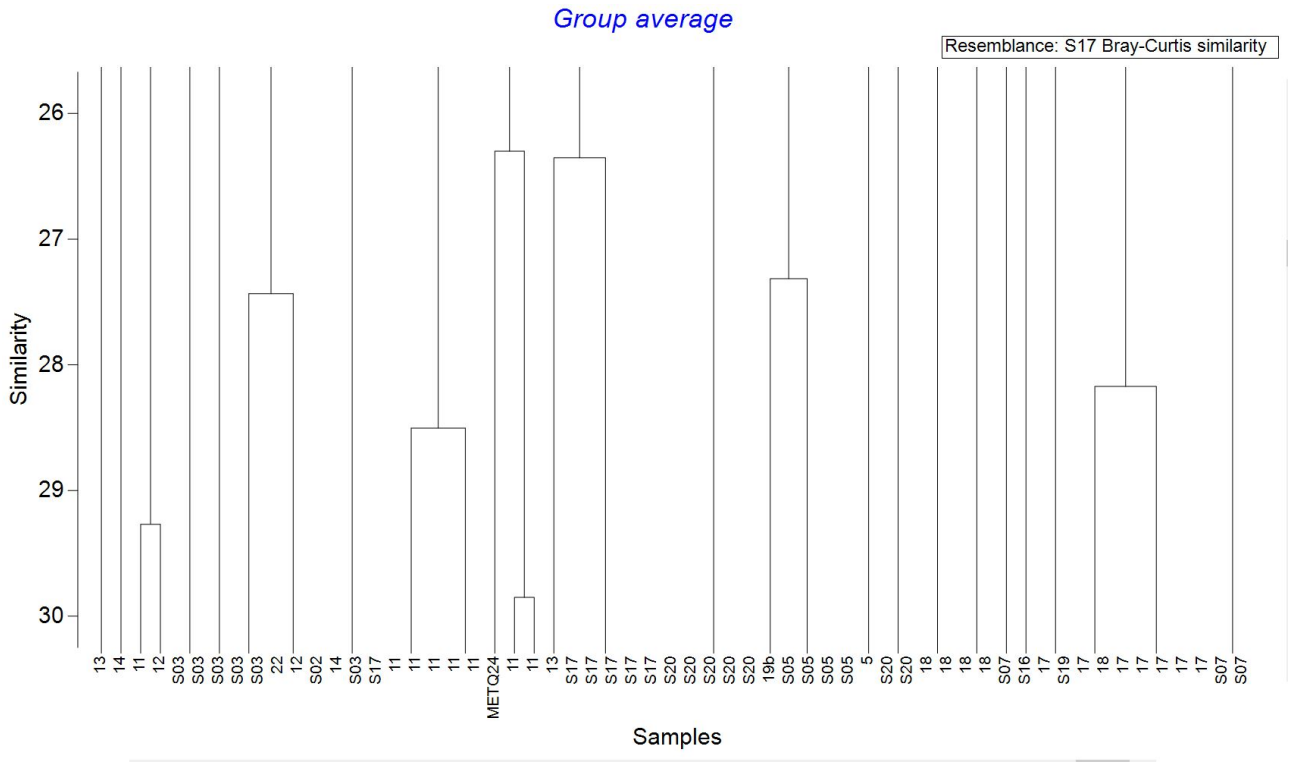
Graph H-30 Relevant portion of classification dendrogram showing relationship between METQ19 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCT21c; FCT21a



Graph H-31 Relevant portion of classification dendrogram showing relationship between METQ22 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCTS17; FCT14; FCTS03



Graph H-32 Relevant portion of classification dendrogram showing relationship between METQ23 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCT21c



Graph H-33 Relevant portion of classification dendrogram showing relationship between METQ24 and combined SCP and supplementary dataset (Keighery et al. 2012) – FCT11