

National Parks and Wildlife Service

Conservation Objectives Series

Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC 000365



An Roinn
Cultúir, Oidhreacht agus Gaeltachta
Department of
Culture, Heritage and the Gaeltacht



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Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

* indicates a priority habitat under the Habitats Directive

000365 Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC

1024	Kerry Slug <i>Geomalacus maculosus</i>
1029	Freshwater Pearl Mussel <i>Margaritifera margaritifera</i>
1065	Marsh Fritillary <i>Euphydryas aurinia</i>
1095	Sea Lamprey <i>Petromyzon marinus</i>
1096	Brook Lamprey <i>Lampetra planeri</i>
1099	River Lamprey <i>Lampetra fluviatilis</i>
1106	Salmon <i>Salmo salar</i>
1303	Lesser Horseshoe Bat <i>Rhinolophus hipposideros</i>
1355	Otter <i>Lutra lutra</i>
1421	Killarney Fern <i>Trichomanes speciosum</i>
1833	Slender Naiad <i>Najas flexilis</i>
3110	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)
3130	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation
4010	Northern Atlantic wet heaths with <i>Erica tetralix</i>
4030	European dry heaths
4060	Alpine and Boreal heaths
5046	Killarney Shad <i>Alosa fallax killarnensis</i>
5130	<i>Juniperus communis</i> formations on heaths or calcareous grasslands
6130	Calaminarian grasslands of the Violetalia calaminariae
6410	<i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)
7130	Blanket bogs (* if active bog)
7150	Depressions on peat substrates of the Rhynchosporion
91A0	Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles
91E0	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae)*
91J0	<i>Taxus baccata</i> woods of the British Isles*

Please note that this SAC overlaps with Killarney National Park SPA (004038) and Iveragh Peninsula SPA (004154) and is adjacent to Ballinskelligs Bay and Inny Estuary SAC (000335), Castlemaine Harbour SAC (000343), Castlemaine Harbour SPA (004029), Blackwater River (Cork/Waterford) SAC (002170) and Blackwater River (Kerry) SAC (002173). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping and adjacent sites as appropriate.

Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year :	1976
Title :	Abbreviated report of a botanical and malacological study performed in the southwestern part of Ireland
Author :	Visser, G; Zoer, J.A.
Series :	Unpublished report to NPWS
Year :	1984
Title :	The vegetation of Irish lakes
Author :	Heuff, H.
Series :	Unpublished report to NPWS
Year :	1987
Title :	The vegetation of Irish rivers
Author :	Heuff, H.
Series :	Unpublished report to NPWS
Year :	1989
Title :	A survey to locate blanket bogs of scientific interest in County Kerry and County Sligo
Author :	Douglas, C.; Garvey, L.; Kelly, L.; O'Sullivan, A.
Series :	Unpublished report to NPWS
Year :	1991
Title :	Survey to locate mountain blanket bogs of scientific interest in Ireland
Author :	Mooney, E.; Goodwillie, R.; Douglas, C.
Series :	Unpublished report to NPWS
Year :	1999
Title :	A survey of four rivers in the south-west of Ireland for the freshwater pearl mussel, <i>Margaritifera margaritifera</i> (L.)
Author :	Ross, E.
Series :	Unpublished report to Duchas, the Heritage Service
Year :	2002
Title :	<i>Najas flexilis</i> in Donegal
Author :	Roden, C.M.
Series :	Unpublished report to NPWS
Year :	2004
Title :	A pilot project to develop a monitoring protocol for the freshwater pearl mussel <i>Margaritifera margaritifera</i> (L.) in the River Caragh, County Kerry, Ireland
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2004
Title :	The distribution of <i>Najas flexilis</i> in Ireland 2002-2004
Author :	Roden, C.M.
Series :	Unpublished report to NPWS
Year :	2005
Title :	Management Plan for Killarney National Park 2005-2009
Author :	NPWS
Series :	Conservation Plan

Year :	2006
Title :	Otter survey of Ireland 2004/2005
Author :	Bailey, M.; Rochford, J.
Series :	Irish Wildlife Manual No. 23
Year :	2006
Title :	Bat mitigation guidelines for Ireland
Author :	Kelleher, C.; Marnell, F.
Series :	Irish Wildlife Manual No. 25
Year :	2006
Title :	Report on searches for juvenile <i>Margaritifera margaritifera</i> (L.) in the Caragh River, Co. Kerry
Author :	Ross, E.D.
Series :	Unpublished report to NPWS
Year :	2007
Title :	A survey of juvenile lamprey populations in the Corrib and Suir catchments
Author :	O'Connor, W.
Series :	Irish Wildlife Manual No. 26
Year :	2007
Title :	Supporting documentation for the Habitats Directive Conservation Status Assessment - backing documents. Article 17 forms and supporting maps
Author :	NPWS
Series :	Unpublished report to NPWS
Year :	2007
Title :	Report on juvenile searches for <i>Margaritifera margaritifera</i> (L.) in the Owenreagh River (Laune)
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2008
Title :	National survey of native woodlands 2003-2008
Author :	Perrin, P.M.; Martin, J.; Barron, S.; O'Neill, F.H.; McNutt, K.E.; Delaney, A.
Series :	Unpublished report to NPWS
Year :	2008
Title :	Rapid Assessment of <i>Margaritifera margaritifera</i> (L.) populations in Ireland: Rivers assessed in 2007
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2009
Title :	Bryophytes and metallophyte vegetation on metalliferous mine-waste in Ireland
Author :	Holyoak, D.T.
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II Freshwater pearl mussel sub-basin management plans: fisheries survey. Stage 1 report
Author :	Paul Johnston Associates
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II Freshwater pearl mussel sub-basin management plans: Report on biological monitoring of surface water quality in Caragh River Catchment
Author :	Conservation Services
Series :	Unpublished report to NPWS

Year :	2009
Title :	NS II Freshwater pearl mussel sub-basin management plans: Report on biological monitoring of surface water quality in Gearhameen River Catchment
Author :	Conservation Services
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II Freshwater pearl mussel sub-basin management plans: monitoring of the freshwater pearl mussel in the Caragh
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II Freshwater pearl mussel sub-basin management plans: monitoring of the freshwater pearl mussel in the Currane
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II Freshwater pearl mussel sub-basin management plans: monitoring of the freshwater pearl mussel in the Gearhameen
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II Freshwater pearl mussel sub-basin management plans: Report on biological monitoring of surface water quality in Cappul (Currane) Catchment, Co. Kerry
Author :	Williams, L.
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II Freshwater pearl mussel sub-basin management plans: Report on biological monitoring of surface water quality in the Cumberagh (Currane) Catchment, Co. Kerry
Author :	Williams, L.
Series :	Unpublished report to NPWS
Year :	2010
Title :	A provisional inventory of ancient and long-established woodland in Ireland
Author :	Perrin, P.M.; Daly, O.H.
Series :	Irish Wildlife Manual No. 46
Year :	2010
Title :	Irish semi-natural grasslands survey. Annual report No.3: Counties Donegal, Dublin, Kildare and Sligo
Author :	O'Neill, F.H.; Martin, J.R.; Devaney, F.M.; McNutt, K.E.; Perrin, P.M.; Delaney, A.
Series :	Unpublished report to NPWS
Year :	2010
Title :	Second draft Caragh freshwater pearl mussel sub-basin management plan (2009-2015). March 2010
Author :	NPWS
Series :	Unpublished document to the Department of the Environment, Heritage and Local Government
Year :	2010
Title :	Second draft Currane freshwater pearl mussel sub-basin management plan (2009-2015). March 2010
Author :	NPWS
Series :	Unpublished document to the Department of the Environment, Heritage and Local Government

Year :	2010
Title :	Second draft Gearhameen freshwater pearl mussel sub-basin management plan (2009-2015). March 2010
Author :	NPWS
Series :	Unpublished document to the Department of the Environment, Heritage and Local Government
Year :	2011
Title :	Distribution and population dynamics of the Kerry Slug, <i>Geomalacus maculosus</i> (Arionidae)
Author :	Mc Donnell, R.J.; Gormally, M.J.
Series :	Irish Wildlife Manual No. 54
Year :	2011
Title :	Ireland Red List No. 5: Amphibians, Reptiles and Freshwater Fish
Author :	King, J.; Marnell, F.; Kingston, N.; Rosell, R.; Boylan, P.; Caffrey, J.M.; Fitzpatrick, Ú.; Gargan, P.G.; Kelly, F.L.; O'Grady, M.F.; Poole, R.; Roche, W.K.; Cassidy, D.
Series :	Ireland Red List series, NPWS
Year :	2011
Title :	Production of a habitat map for Killarney National Park, Co. Kerry
Author :	Barron, S.; Perrin, P.
Series :	Unpublished report to NPWS
Year :	2011
Title :	Caragh River System 2011 <i>Margaritifera</i> monitoring results 2011
Author :	Ross, E.D.
Series :	Unpublished report to NPWS
Year :	2012
Title :	The conservation status of juniper formations in Ireland
Author :	Cooper, F.; Stone, R.E.; McEvoy, P.; Wilkins, T.; Reid, N.
Series :	Irish Wildlife Manual No. 63
Year :	2012
Title :	An assessment of the use of conifer plantations by the Kerry Slug <i>Geomalacus maculosus</i> with reference to the potential impacts of forestry operations
Author :	Reich, I.; O'Meara, K.; Mc Donnell, R.J.; Gormally, M.J.
Series :	Irish Wildlife Manual No. 64
Year :	2012
Title :	Ireland Red List No. 8: Bryophytes
Author :	Lockhart, N.; Hodgetts, N.; Holyoak, D.
Series :	Ireland Red List series, NPWS
Year :	2012
Title :	National Survey of Upland Habitats (Phase II, 2011-2012), site report No. 8: Killarney National Park, Co. Kerry
Author :	Roche, J.R.; Perrin, P.M.; Barron, S.J.; Daly, O.H.
Series :	Unpublished report to NPWS
Year :	2013
Title :	National otter survey of Ireland 2010/12
Author :	Reid, N.; Hayden, B.; Lundy, M.G.; Pietravalle, S.; McDonald, R.A.; Montgomery, W.I.
Series :	Irish Wildlife Manual No. 76
Year :	2013
Title :	Irish semi-natural grasslands survey 2007-2012
Author :	O'Neill, F.H.; Martin, J.R.; Devaney, F.M.; Perrin, P.M.
Series :	Irish Wildlife Manual No. 78

Year :	2013
Title :	Results of a monitoring survey of old sessile oak woods and alluvial forests
Author :	O'Neill, F.H.; Barron, S.J.
Series :	Irish Wildlife Manual No. 71
Year :	2013
Title :	Results of a monitoring survey of yew woodland
Author :	Cross, J.; Lynn, D.
Series :	Irish Wildlife Manual No. 72
Year :	2013
Title :	The status of EU protected habitats and species in Ireland. Volume 2. Habitats assessments
Author :	NPWS
Series :	Conservation assessments
Year :	2013
Title :	The status of EU protected habitats and species in Ireland. Volume 3. Species assessments
Author :	NPWS
Series :	Conservation assessments
Year :	2013
Title :	Irish semi-natural grasslands survey annual report No. 4: Western seaboard counties (Clare, Galway, Kerry, Limerick, Mayo) and County Tipperary
Author :	Devaney, F.M.; Martin, J.R.; O'Neill, F.H.; Delaney, A.
Series :	Unpublished report to NPWS
Year :	2014
Title :	Species dossier, range and distribution data for the Hairy Wood Ant, <i>Formica lugubris</i> , in Ireland
Author :	Breen, J.
Series :	Irish Wildlife Manual No. 68
Year :	2014
Title :	Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland, Version 2.0
Author :	Perrin, P.M.; Barron, S.J.; Roche, J.R.; O'Hanrahan, B.
Series :	Irish Wildlife Manual No. 79
Year :	2014
Title :	Targeted survey of <i>Najas flexilis</i>
Author :	Roden, C.; Murphy, P.
Series :	Unpublished report to NPWS
Year :	2015
Title :	Habitats Directive Annex I lake habitats: a working interpretation for the purposes of site-specific conservation objectives and Article 17 reporting
Author :	O Connor, Á.
Series :	Unpublished document by NPWS
Year :	2015
Title :	Monitoring methods for the Killarney fern (<i>Trichomanes speciosum</i> Willd.) in Ireland
Author :	Ní Dhúill, E.; Smyth, N.; Waldren, S.; Lynn, D.
Series :	Irish Wildlife Manual No. 82
Year :	2015
Title :	KerryLIFE Project, 2014 surveys of the Kerry Blackwater and Caragh Rivers
Author :	Moorkens, E.A.
Series :	Unpublished report to NPWS

Year :	2015
Title :	Surveys of possible marsh fritillary sites and habitat in Cos. Clare (outside the Burren) and Kerry, final report
Author :	Barron, S.J.; Daly, O.H.
Series :	Unpublished report to NPWS
Year :	2016
Title :	Ireland Red List No. 10: Vascular Plants
Author :	Wyse Jackson, M.; FitzPatrick, Ú.; Cole, E.; Jebb, M.; McFerran, D.; Sheehy Skeffington, M.; Wright, M.
Series :	Ireland Red Lists series, NPWS
Year :	2016
Title :	KerryLIFE Project. Condition assessment of freshwater pearl mussel populations in the Kerry Blackwater and Caragh rivers in 2016
Author :	Moorkens, E.
Series :	Unpublished report to NPWS
Year :	2016
Title :	Freshwater pearl mussel survey of a section of the Gearhameen River extending downstream from the bridge at Lord Brandon's Cottage on August 15th, 2016
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2017
Title :	Cummeragh River, 2014 <i>Margaritifera</i> monitoring results
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2017
Title :	Owenreagh River (Laune System), 2015 <i>Margaritifera</i> monitoring results
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2017
Title :	Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC (site code: 365) Conservation objectives supporting document- blanket bogs and associated habitats V1
Author :	NPWS
Series :	Conservation objectives supporting document
Year :	2017
Title :	Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC (site code: 365) Conservation objectives supporting document- <i>Najas flexilis</i> V1
Author :	NPWS
Series :	Conservation objectives supporting document

Other References

Year :	1916
Title :	Flora of County Kerry
Author :	Scully, R.W.
Series :	Hodges, Figgis & Company Ltd., Dublin
Year :	1972
Title :	Verslag van een botanisch/malacologische studiereis naar Z.W. Ierland
Author :	Visser, G.; Zoer, J.A.
Series :	Unpublished Report; Rijksinstituut voor Natuurbeheer, Leersum, Netherlands

Year :	1981
Title :	The native forest vegetation of Killarney, south-west Ireland: An ecological account
Author :	Kelly, D.L.
Series :	Journal of Ecology, 69: 437-472
Year :	1982
Title :	Otter survey of Ireland
Author :	Chapman, P.J.; Chapman, L.L.
Series :	Unpublished report to Vincent Wildlife Trust
Year :	1982
Title :	Eutrophication of waters. Monitoring assessment and control
Author :	OECD
Series :	OECD, Paris
Year :	1984
Title :	Ecology of European Rivers
Author :	Whitton, B.A. (ed.)
Series :	Blackwell Scientific Publishing
Year :	1991
Title :	The spatial organization of otters (<i>Lutra lutra</i>) in Shetland
Author :	Kruuk, H.; Moorhouse, A.
Series :	Journal of Zoology, 224: 41-57
Year :	1996
Title :	The conservation of aquatic systems
Author :	Reynolds, J.D. (ed.)
Series :	Royal Irish Academy, Dublin
Year :	1997
Title :	Irish wetland woods: the plant communities and their ecology
Author :	Kelly, D.L.; Iremonger, S.F.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 97B: 1-32
Year :	2000
Title :	Appendix 2. Notes on the status and ecology of <i>Ditrichum cornubicum</i>
Author :	Holyoak, D.T.; Clements, R.; Coleman, M.R.J.; MacPherson, K.S.
Series :	English Nature Research Reports, No. 328: 40-50
Year :	2000
Title :	Colour in Irish lakes
Author :	Free, G.; Allott, N.; Mills, P.; Kennelly, C.; Day, S.
Series :	Verhandlungen Internationale Vereinigung für theoretische und angewandte Limnologie, 27: 2620-2623
Year :	2001
Title :	Heavy metal concentrations in the soil substrates associated with rare bryophytes at former metalliferous mining sites in East Cornwall
Author :	Walsh, L.
Series :	Unpublished B.Sc. Thesis, University of Hertfordshire
Year :	2001
Title :	Aquatic plants in Britain and Ireland
Author :	Preston, C.D.; Croft, J.M.
Series :	Harley Books, Colchester

Year :	2002
Title :	Reversing the habitat fragmentation of British woodlands
Author :	Peterken, G.
Series :	WWF-UK, London
Year :	2002
Title :	Deterioration of Atlantic soft water macrophyte communities by acidification, eutrophication and alkalinisation
Author :	Arts, G.H.P.
Series :	Aquatic Botany, 73: 373-393
Year :	2002
Title :	Habitat selection by larvae of a fluvial lamprey, <i>Lethenteron reissneri</i> , in a small stream and an experimental aquarium
Author :	Sugiyama H.; Goto A.
Series :	Ichthyological Research, 49(1): 62–68
Year :	2003
Title :	Monitoring the river, brook and sea lamprey, <i>Lampetra fluviatilis</i> , <i>L. planeri</i> and <i>Petromyzon marinus</i>
Author :	Harvey, J.; Cowx, I.
Series :	Conserving Natura 2000 Rivers Monitoring Series No. 5. English Nature, Peterborough
Year :	2003
Title :	Ecology of watercourses characterised by Ranunculion fluitantis and Callitriche-Batrachion vegetation
Author :	Hatton-Ellis, T.W.; Grieve, N.
Series :	Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough
Year :	2003
Title :	Identifying lamprey. A field key for sea, river and brook lamprey
Author :	Gardiner, R.
Series :	Conserving Natura 2000 rivers, Conservation techniques No. 4. English Nature, Peterborough
Year :	2004
Title :	The ecology of <i>Najas flexilis</i>
Author :	Wingfield, R.A.; Murphy, K.J.; Hollingsworth, P.; Gaywood, M.J.
Series :	Scottish Natural Heritage Commissioned Report No. 017 (ROAME No. F98PA02)
Year :	2005
Title :	Common standards monitoring guidance for freshwater fauna
Author :	JNCC
Series :	Joint Nature Conservation Committee, Peterborough
Year :	2006
Title :	Otters - ecology, behaviour and conservation
Author :	Kruuk, H.
Series :	Oxford University Press
Year :	2006
Title :	The status of host fish populations and fish species richness in European freshwater pearl mussel (<i>Margaritifera margaritifera</i>) streams
Author :	Geist, J.; Porkka, M.; Kuehn, R.
Series :	Aquatic Conservation: Marine and Freshwater Ecosystems, 16: 251-266

Year :	2006
Title :	A reference-based typology and ecological assessment system for Irish lakes. Preliminary investigations. Final report. Project 2000-FS-1-M1 Ecological assessment of lakes pilot study to establish monitoring methodologies EU (WFD)
Author :	Free, G.; Little, R.; Tierney, D.; Donnelly, K.; Coroni, R.
Series :	EPA, Wexford
Year :	2007
Title :	Evolutionary history of lamprey paired species <i>Lampetra fluviatilis</i> L. and <i>Lampetra planeri</i> Bloch as inferred from mitochondrial DNA variation
Author :	Espanhol, R.; Almeida, P.R.; Alves, M.J.
Series :	Molecular Ecology, 16: 1909-1924
Year :	2007
Title :	Protecting and managing underground sites for bats
Author :	Mitchell-Jones, A.J.; Bihari, Z.; Masing, M.; Rodrigues, L.
Series :	EUROBATS Publication Series No. 2
Year :	2008
Title :	Poor water quality constrains the distribution and movements of twaite shad (<i>Alosa fallax fallax</i> , Lacepede, 1803) in the watershed of river Scheldt
Author :	Maas, J.; Stevens, M.; Breine, J.
Series :	Hydrobiologia, 602: 129-143
Year :	2008
Title :	The lesser horseshoe bat conservation handbook
Author :	Schofield, H.W.
Series :	The Vincent Wildlife Trust
Year :	2008
Title :	Water Quality in Ireland 2004-2006
Author :	Clabby, K.J.; Bradley, C.; Craig, M.; Daly, D.; Lucey, J.; McGarrigle, M.; O'Boyle, S.; Tierney, D.; Bowman, J.
Series :	EPA, Wexford
Year :	2008
Title :	Conservation of Ireland's biodiversity: A survey and assessment of the current status of three Irish endemic hawkweeds from Kerry, <i>Hieracium argentatum</i> , <i>H. scullyi</i> and <i>H. sparsifrons</i> (Asteraceae)
Author :	Rich, T.C.G.; Hodd, R.L.I.B.; McCosh, D.J.; Mhic Daeid, E.C.; McVeigh, A.; Sawtschuk, J.; Wyse Jackson, M.B.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 108B(3): 143-155
Year :	2009
Title :	The identification, characterization and conservation value of isoetid lakes in Ireland
Author :	Free, G.; Bowman, J.; McGarrigle, M.; Little, R.; Coroni, R.; Donnelly, K.; Tierney, D.; Trodd, W.
Series :	Aquatic Conservation: Marine and Freshwater Ecosystems, 19(3): 264-273
Year :	2010
Title :	Otter tracking study of Roaringwater Bay
Author :	De Jongh, A.; O'Neill, L.
Series :	Unpublished draft report to NPWS
Year :	2010
Title :	Addressing the conservation and rehabilitation of <i>Margaritifera margaritifera</i> populations in the Republic of Ireland within the framework of the habitats and species directive
Author :	Moorkens, E.
Series :	Journal of Conchology, 40: 339

Year :	2010
Title :	Water quality in Ireland 2007-2009
Author :	McGarrigle, M.; Lucey, J.; Ó Cinnéide, M.
Series :	EPA, Wexford
Year :	2011
Title :	National Programme: Habitats Directive and Red Data Book fish species. Executive report 2011
Author :	Inland Fisheries Ireland (IFI)
Series :	IFI Report Number: IFI/2012/1-4103
Year :	2011
Title :	Long-term deer exclusion in yew-wood and oakwood habitats in southwest Ireland: Changes in ground flora and species diversity
Author :	Perrin, P.M.; Mitchell, F.J.G.; Kelly, D.L.
Series :	Forest Ecology and Management, 262: 2328-2337
Year :	2012
Title :	Rare and threatened bryophytes of Ireland
Author :	Lockhart, N.; Hodgetts, N.; Holyoak, D.
Series :	National Museums Northern Ireland
Year :	2012
Title :	Water Framework Directive fish stock survey of Lough Leane, September 2011
Author :	Kelly, F.L.; Connor, L.; Morrissey, E.; Wogerbauer, C.; Matson, R.; Feeney, R.; Rocks, K.
Series :	Inland Fisheries Ireland
Year :	2013
Title :	Aspects of brook lamprey (<i>Lampetra planeri</i> Bloch) spawning in Irish waters
Author :	Rooney, S.M.; O'Gorman, N.M.; Green, F.; King, J.J.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 113B(1): 13-25
Year :	2013
Title :	Conservation of selected legally protected and Red Listed bryophytes in Ireland
Author :	Campbell, C.
Series :	Unpublished Ph.D. Thesis, Trinity College Dublin
Year :	2013
Title :	Management strategies for the protection of high status water bodies
Author :	Ní Chatháin, B.; Moorkens, E.; Irvine, K.
Series :	Strive Report Series No. 99. EPA, Wexford
Year :	2013
Title :	Interpretation manual of European Union habitats- Eur 28
Author :	European Commission- DG Environment
Series :	European Commission
Year :	2013
Title :	Revised distribution and habitat associations for the protected slug, <i>Geomalacus maculosus</i> (Stylommatophora: Arionidae) in Ireland
Author :	Mc Donnell, R.J.; O'Meara, K.; Nelson, B.; Marnell, F.; Gormally, M.J.
Series :	Basteria, 77: 33-37
Year :	2013
Title :	A species-to-be? The genetic status and colonization history of the critically endangered Killarney shad
Author :	Coscia, I.; McDevitt, A.D.; King, J.J.; Roche, W.K.; McLoughlin, C.; Mariani, S.
Series :	Molecular Phylogenetics and Evolution, 69(3): 1190-1195

Year :	2014
Title :	Assessing near-bed velocity in a recruiting population of the endangered freshwater pearl mussel (<i>Margaritifera margaritifera</i>) in Ireland
Author :	Moorkens, E.; Killeen, I.
Series :	Aquatic Conservation: Marine and Freshwater Ecosystems, 24(6): 853-862
Year :	2015
Title :	Water quality in Ireland 2010-2012
Author :	Bradley, C.; Byrne, C.; Craig, M.; Free, G.; Gallagher, T.; Kennedy, B.; Little, R.; Lucey, J.; Mannix, A.; McCreesh, P.; McDermott, G.; McGarrigle, M.; Ní Longphuirt, S.; O'Boyle, S.; Plant, C.; Tierney, D.; Trodd, W.; Webster, P.; Wilkes, R.; Wynne, C.
Series :	EPA, Wexford
Year :	2015
Title :	Common standards monitoring guidance for freshwater fauna. Version October 2015
Author :	JNCC
Series :	Joint Nature Conservation Committee, Peterborough
Year :	2015
Title :	Water Framework Directive fish stock survey of Lough Leane, September 2014
Author :	Kelly, F.L.; Connor, L.; Morrissey, E.; Coyne, J.; Feeney, R.; Matson, R.; Rocks, K.
Series :	Inland Fisheries Ireland
Year :	2015
Title :	A Catalogue and Atlas of the Caddisflies (Trichoptera) of Ireland
Author :	O'Connor, J.P.
Series :	Occasional Publication of the Irish Biogeographical Society, No. 11
Year :	2016
Title :	A narrative for conserving freshwater and wetland habitats in England
Author :	Mainstone, C.; Hall, R.; Diack, I.
Series :	Natural England Research Reports Number 064
Year :	2016
Title :	The Status of Irish Salmon Stocks in 2015 with Precautionary Catch Advice for 2016
Author :	SSCS (Standing Scientific Committee on Salmon)
Series :	Independent Scientific Report to Inland Fisheries Ireland

Spatial data sources

Year :	2008
Title :	OSi 1:5000 IG vector dataset
GIS Operations :	WaterPolygons feature class clipped to the SAC boundary. Expert opinion used to identify Annex I habitats and to resolve any issues arising
Used For :	3110, 3130 (map 3)
Year :	2012
Title :	Bryophytes and Metallophyte Vegetation on Metalliferous Mine-waste in Ireland
GIS Operations :	Sites identified; clipped to SAC boundary
Used For :	6130 (map 4)
Year :	2013
Title :	Irish Semi-Natural Grassland Survey
GIS Operations :	Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	6410 (map 4)
Year :	2011
Title :	Habitat map for Killarney National Park
GIS Operations :	QIs selected; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	91A0, 91E0, 91J0 (maps 5 and 6)
Year :	Revision 2010
Title :	National Survey of Native Woodlands 2003-2008. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	91A0, 91E0, 91J0 (maps 5 and 6)
Year :	2017
Title :	NPWS rare and threatened species database
GIS Operations :	Dataset created from spatial references in database records. Expert opinion used as necessary to resolve any issues arising
Used For :	1024, 1029, 1065 (maps 7, 8 and 9)
Year :	Revision 2012
Title :	Margaritifera Sensitive Areas data
GIS Operations :	Relevant catchment boundaries identified. Expert opinion used as necessary to resolve any issues arising
Used For :	1029 (map 8)
Year :	2012
Title :	NPWS lesser horseshoe bat database
GIS Operations :	Roosts identified, clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	1303 (map 10)
Year :	2007
Title :	Forest Inventory and Planning System, (FIPS)
GIS Operations :	Dataset clipped to 2.5km buffer centred on roost locations
Used For :	1303 (map 10)

Year :	2005
Title :	OSi Discovery series vector data
GIS Operations :	Creation of 10m buffer on terrestrial side of river banks data; creation of 20m buffer applied to canal centreline data. Creation of 20m buffer applied to river and stream centreline data; These datasets combined with derived OSi 1:5000 vector lake buffer data. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	1355 (map 11)
Year :	2010
Title :	OSi 1:5000 IG vector dataset
GIS Operations :	Creation of 80m buffer on aquatic side of lake data; creation of 10m buffer on terrestrial side of lake data. These datasets combined with derived OSi Discovery Series river and canal datasets. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising. Creation of 250m buffer on aquatic side of the lake boundary to highlight potential commuting points
Used For :	1355 (map 11)
Year :	2013
Title :	Najas flexilis data
GIS Operations :	Lake habitat for species clipped to SAC boundary
Used For :	1833 (map 12)

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

3110 Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)

To restore the favourable conservation condition of Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Lake habitat 3110 is considered likely to occur in most lakes in the SAC, notably in upland corrie lakes (where it may co-occur with lake habitat 3160) and lowland lakes such as Currane, Muckcross, Guitane and Derriana. It may also co-occur with lake habitat 3160 in lakes/ponds in blanket bog. It is likely to co-occur with lake habitat 3130 in Leane, Caragh, Muckcross, the Upper Lake and Acoose. In line with Article 17 reporting (NPWS, 2013), all lakes larger than 1ha were mapped as potential 3110 (see map 3). It is likely, however, that the habitat also occurs in many of the smaller lakes and ponds in the SAC. Two measures of extent should be used: 1. the area of the lake itself and; 2. the extent of the vegetation communities/zones that typify the habitat. Further information relating to all attributes is provided in the lake habitats supporting document for the purposes of site-specific conservation objectives and Article 17 reporting (O Connor, 2015)
Habitat distribution	Occurrence	No decline, subject to natural processes	As noted above, all lakes larger than 1ha have been mapped as potential 3110, but the habitat is likely to be even more widespread in the SAC (see map 3)
Typical species	Occurrence	Typical species present, in good condition, and demonstrating typical abundances and distribution	For lists of typical plant species, see the Article 17 habitat assessment for 3110 (NPWS, 2013) and the lake habitats supporting document (O Connor, 2015). See Visser and Zoer (1972, 1976), Heuff (1984) and the 000365 conservation objectives supporting document for <i>Najas flexilis</i> for information on the specific lakes in the SAC. Lakes in the SAC are important for invertebrates, including water beetles, dragonflies, caddisflies and mayflies. Leane has an important fish community with its freshwater population of Killarney shad (<i>Alosa fallax killarneyensis</i>) and Arctic charr (<i>Salvelinus alpinus</i>) (Maitland, 1996 in Reynolds, 1996). Killarney shad is a qualifying interest for the SAC. Leane, Muckcross, the Upper Lake, Currane, Cloonaghlin, Namona, Derriana, Caragh, Acoose, Cummernamuck, Brin and Guitane are Water Framework Directive (WFD) monitoring lakes and regular macrophyte surveys are conducted by the Environmental Protection Agency (EPA)
Vegetation composition: characteristic zonation	Occurrence	All characteristic zones should be present, correctly distributed and in good condition	Further work is necessary to describe the characteristic zonation and other spatial patterns in lake habitat 3110 (see O Connor, 2015). Lake-specific information on vegetation zonation may be available from Visser and Zoer (1972, 1976), Heuff (1984), EPA surveys and other sources
Vegetation distribution: maximum depth	Metres	Maintain maximum depth of vegetation, subject to natural processes	The maximum depth of vegetation is likely to be specific to the lake shoreline in question. Further work is necessary to develop indicative targets for lake habitat 3110. Maximum depth should be large in lakes in the SAC within undisturbed peatland and uplands; however, pressures such as eutrophication, overgrazing, forestry and peat-cutting may have reduced vegetation depth in some lakes

Hydrological regime: water level fluctuations	Metres	Maintain appropriate natural hydrological regime necessary to support the habitat	Fluctuations in lake water level are typical in Ireland, but can be amplified by activities such as abstraction, drainage and overgrazing. Increased water level fluctuations can increase wave action, up-root vegetation, increase turbidity, alter the substratum and lead to release of nutrients from the sediment. The hydrological regime of the lakes must be maintained so that the area, distribution and depth of the lake habitat and its constituent/characteristic vegetation zones and communities are not reduced
Lake substratum quality	Various	Maintain appropriate substratum type, extent and chemistry to support the vegetation	Research is required to further characterise the substratum types (particle size and origin) and substratum quality (notably pH, calcium, iron and nutrient concentrations) favoured by each of the five Annex I lake habitats in Ireland. It is likely that lake habitat 3110 is associated with a range of nutrient-poor substrates, from stones, cobble and gravel, through sands, silt, clay and peat. Substratum particle size is likely to vary with depth and along the shoreline within a single lake
Water quality: transparency	Metres	Maintain/restore appropriate Secchi transparency. There should be no decline in Secchi depth/transparency	Transparency relates to light penetration and, hence, to the depth of colonisation of vegetation. It can be affected by phytoplankton blooms, water colour and turbidity. Specific targets have yet to be established for lake habitat 3110 (O Connor, 2015). Habitat 3110 is associated with very clear water. The OECD fixed boundary system set transparency targets for oligotrophic lakes of $\geq 6\text{m}$ annual mean Secchi disk depth, and $\geq 3\text{m}$ annual minimum Secchi disk depth. Free et al. (2009) found high isoetid abundance in lakes with Secchi depths of more than 3m. Secchi data for 2007-09 indicate that Acoose, Brin, Caragh, Currane, Leane and the Upper Lake failed both OECD targets, while Guitane and Muckcross passed minimum, but failed mean, targets (McGarrigle et al., 2010)
Water quality: nutrients	$\mu\text{g/l P}$; mg/l N	Maintain/restore the concentration of nutrients in the water column to sufficiently low levels to support the habitat and its typical species	As a nutrient-poor habitat, oligotrophic and WFD 'high' status targets apply. Where a lake has nutrient concentrations that are lower than these targets, there should be no decline within class, i.e. no upward trend in nutrient concentrations. For lake habitat 3110, annual average total phosphorus (TP) concentration should be $\leq 10\mu\text{g/l TP}$, average annual total ammonia concentration should be $\leq 0.040\text{mg/l N}$ and annual 95th percentile for total ammonia should be $\leq 0.090\text{mg/l N}$. See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009. Acoose, Caragh, Cummernamuck and Leane failed the target (having good nutrient status) in 2010-12 (Bradley et al., 2015). Brin, Currane, Cummernamuck (moderate status), Leane and Namona failed in 2007-09 (McGarrigle et al., 2010)
Water quality: phytoplankton biomass	$\mu\text{g/l Chlorophyll } a$	Maintain/restore appropriate water quality to support the habitat, including high chlorophyll <i>a</i> status	Oligotrophic and WFD 'high' status targets apply to lake habitat 3110. Where a lake has a chlorophyll <i>a</i> concentration that is lower than this target, there should be no decline within class, i.e. no upward trend in phytoplankton biomass. The average growing season (March-October) chlorophyll <i>a</i> concentration must be $< 5.8\mu\text{g/l}$. The annual average chlorophyll <i>a</i> concentration should be $< 2.5\mu\text{g/l}$ and the annual peak chlorophyll <i>a</i> concentration should be $\leq 8.0\mu\text{g/l}$. See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009. Acoose (moderate status), Cummernamuck and Currane failed to reach high status in 2007-2009 and in 2010-2012; Brin also failed in 2010-2012 (McGarrigle et al., 2010; Bradley et al., 2015)

Water quality: phytoplankton composition	EPA phytoplankton composition metric	Maintain/restore appropriate water quality to support the habitat, including high phytoplankton composition status	The EPA has developed a phytoplankton composition metric for nutrient enrichment of Irish lakes. As for other water quality indicators, lake habitat 3110 requires WFD high status. Caragh and Leane had high phytoplankton composition status in 2010-12, but the Upper Lake had good (Bradley et al., 2015)
Water quality: attached algal biomass	Algal cover and EPA phytobenthos metric	Maintain/restore trace/absent attached algal biomass (<5% cover) and high phytobenthos status	Nutrient enrichment can favour epiphytic and epipelic algae that can out-compete the submerged vegetation. The cover abundance of attached algae in habitat 3110 should, therefore, be trace/absent (<5% cover). EPA phytobenthos can be used as an indicator of changes in attached algal biomass. As for other water quality indicators, lake habitat 3110 requires high phytobenthos status. Brin and the Upper Lake had high phytobenthos status in 2010-12, but Acoose, Caragh and Leane had good (Bradley et al., 2015)
Water quality: macrophyte status	EPA macrophyte metric (The Free Index)	Maintain/restore high macrophyte status	Nutrient enrichment can favour more competitive submerged macrophyte species that out-compete the typical and characteristic species for the lake habitat. The EPA monitors macrophyte status for WFD purposes using the 'Free Index'. The target for lake habitat 3110 is high status or an Ecological Quality Ratio (EQR) for lake macrophytes of ≥ 0.90 , as defined in Schedule Five of the European Communities Environmental Objectives (Surface Waters) Regulations 2009. Of the monitored lakes, Leane failed the target in 2007-2009 and 2010-2012, Caragh in 2010-2012, and Brin in 2007-2009, all having good macrophyte status (McGarrigle et al., 2010; Bradley et al., 2015)
Acidification status	pH units; mg/l	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the habitat, subject to natural processes	Acidification can impact on species abundance and composition in soft water lake habitats. In Europe, acidification of isoetid lakes can lead to loss of isoetids and dominance by submerged <i>Sphagnum</i> mosses and <i>Juncus bulbosus</i> (Arts, 2002). The specific requirements of lake habitat 3110, in terms of water and sediment pH, alkalinity and cation concentration, have not been determined. For lake habitat 3110, and adopting a precautionary approach based on Arts (2002), minimum pH should not be <5.5 pH units. Maximum pH should be <9.0 pH units, in line with the surface water standards established for soft waters (where water hardness is ≤ 100 mg/l calcium carbonate). See Schedule Five of the European Communities Environmental Objectives (Surface Waters) Regulations 2009. See McGarrigle et al. (2010) and Bradley et al. (2015) for WFD acidification status in the 2007-09 and 2010-12 periods
Water colour	mg/l PtCo	Maintain appropriate water colour to support the habitat	Increased water colour and turbidity decrease light penetration and can reduce the area of available habitat for lake macrophytes, particularly at the lower euphotic depths. The primary source of increased water colour in Ireland is disturbance to peatland. No habitat-specific or national standards for water colour currently exist. Studies have shown median colour concentrations in Irish lakes of 38mg/l PtCo (Free et al., 2000) and 33mg/l PtCo (Free et al., 2006). It is likely that the water colour in all Irish lake habitats would naturally be <50mg/l PtCo. Water colour can be very low (<20mg/l PtCo or even <10mg/l PtCo) in lake habitat 3110 where the peatland in the lake's catchment is intact. Free et al. (2006) reported colour of 23mg/l, 15mg/l, 17mg/l, 13mg/l, 15mg/l and 22mg/l PtCo in Caragh, Cloonaghlin, Currane, Guitane, Muckcross and the Upper Lake, respectively

Dissolved organic carbon (DOC)	mg/l	Maintain appropriate organic carbon levels to support the habitat	Dissolved (and particulate) organic carbon (OC) in the water column is linked to water colour and acidification (organic acids). Increasing DOC in water has been documented across the Northern Hemisphere, including afforested peatland catchments in Ireland. Damage and degradation of peatland, leading to decomposition of peat, is likely to be the predominant source of OC in Ireland. OC in water promotes decomposition by fungi and bacteria that, in turn, releases dissolved nutrients. The increased biomass of decomposers can also impact directly on the characteristic lake communities through shading, competition, etc.
Turbidity	Nephelometric turbidity units/ mg/l SS/ other appropriate units	Maintain appropriate turbidity to support the habitat	Turbidity can significantly affect the quantity and quality of light reaching rooted and attached vegetation and can, therefore, impact on lake habitats. The settlement of higher loads of inorganic or organic material on lake vegetation communities may also have impacts on sensitive, delicate species. Turbidity can increase as a result of re-suspension of material within the lake, higher loads entering the lake, or eutrophication. Turbidity measurement and interpretation is challenging. As a result, it is likely to be difficult to set habitat-specific targets for turbidity in lakes
Fringing habitat: area and condition	Hectares	Maintain the area and condition of fringing habitats necessary to support the natural structure and functioning of habitat 3110	Most lake shorelines have fringing habitats of reedswamp, other swamp, fen, marsh or wet woodland that intergrade with and support the structure and functions of the lake habitat. In this SAC, lake shorelines are likely to have a wide variety of fringing habitats, from wet and dry native woodland, to grassland, swamp, poor fen, heath, blanket bog and rock communities. Fringing habitats are dependent on the lake, particularly its water levels, and support wetland communities and species of conservation concern. Many of the fringing wetland habitats support higher invertebrate and plant species richness than the lake habitats themselves

Conservation Objectives for : Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC [000365]

3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea

To restore the favourable conservation condition of Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoeto-Nanojuncetea in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Lake habitat 3130 is considered likely to occur in Loughs Acoose, Caragh, Leane, The Long Range and the Upper Lake in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC (see map 3). It may also occur in Muckross Lake and other lakes in the SAC. It is likely to co-occur with lake habitat 3110 in these lakes. Two measures of extent should be used: 1. the area of the lake itself and; 2. the extent of the vegetation communities/zones that typify the habitat. Further information relating to all attributes is provided in the lake habitats supporting document for the purposes of site-specific conservation objectives and Article 17 reporting (O Connor, 2015). See also the Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC conservation objectives supporting document for <i>Najas flexilis</i>
Habitat distribution	Occurrence	No decline, subject to natural processes	The characteristics and distribution of lake habitat 3130 in Ireland are not yet fully understood. The Annex II macrophyte <i>Najas flexilis</i> (slender naiad) is considered to be characteristic of the habitat and occurs in Acoose, Caragh, Leane, The Long Range and the Upper Lake (see map 3). As noted above, the habitat may be more widespread in the SAC. See O Connor (2015) and the <i>Najas flexilis</i> conservation objectives supporting document for further information
Typical species	Occurrence	Typical species present, in good condition, and demonstrating typical abundances and distribution	For lists of typical plant species, see the Article 17 habitat assessment for 3130 (NPWS, 2013), O Connor (2015) and the <i>Najas flexilis</i> conservation objectives supporting document. Regular macrophyte surveys are conducted by the Environmental Protection Agency (EPA) at Water Framework Directive (WFD) monitoring lakes. Lakes in the SAC are important for invertebrates, including water beetles, dragonflies, caddisflies and mayflies
Vegetation composition: characteristic zonation	Occurrence	All characteristic zones should be present, correctly distributed and in good condition	Further work is necessary to describe the characteristic zonation and other spatial patterns in lake habitat 3130 (see O Connor, 2015). Lake-specific information on vegetation zonation may be available from Visser and Zoer (1972, 1976), Heuff (1984), EPA surveys and other sources
Vegetation distribution: maximum depth	Metres	Maintain maximum depth of vegetation, subject to natural processes	The maximum depth of vegetation is likely to be specific to the lake shoreline in question. Further work is necessary to develop indicative targets for lake habitat 3130. Maximum depth should be large in lakes in the SAC within undisturbed peatland and uplands; however, pressures such as eutrophication, overgrazing, forestry and peat-cutting may have reduced vegetation depth in some lakes

Hydrological regime: water level fluctuations	Metres	Maintain appropriate natural hydrological regime necessary to support the habitat	Fluctuations in lake water level are typical in Ireland, but can be amplified by activities such as abstraction, drainage and overgrazing. Increased water level fluctuations can increase wave action, up-root vegetation, increase turbidity, alter the substratum and lead to release of nutrients from the sediment. The hydrological regime of the lakes must be maintained so that the area, distribution and depth of the lake habitat and its constituent/characteristic vegetation zones and communities are not reduced
Lake substratum quality	Various	Maintain appropriate substratum type, extent and chemistry to support the vegetation	Research is required to further characterise the substratum types (particle size and origin) and substratum quality (notably pH, calcium, iron and nutrient concentrations) favoured by each of the five Annex I lake habitats in Ireland. It is likely that lake habitat 3130 is associated with a range of substrate types that are more productive/base-rich relative to the substratum of lake habitat 3110. Substratum particle size is likely to vary with depth and along the shoreline within a single lake; however, it should be noted that <i>Najas flexilis</i> is typically found on soft substrata of mud, silt or fine sand (Preston and Croft, 2001; Roden, 2002, 2004). For further information see the lake habitats supporting document (O Connor, 2015) and the <i>Najas flexilis</i> supporting document
Water quality: transparency	Metres	Maintain/restore appropriate Secchi transparency. There should be no decline in Secchi depth/transparency	Transparency relates to light penetration and, hence, to the depth of colonisation of vegetation. It can be affected by phytoplankton blooms, water colour and turbidity. Specific targets have yet to be established for lake habitat 3130 (O Connor, 2015). Habitat 3130 is associated with clear water, as evidenced by the growth of the character species <i>Najas flexilis</i> at depths of up to 10m. There is likely to be some variation in Secchi depth across lakes with habitat 3130 and site-specific conditions should also be considered. The OECD fixed boundary system set transparency targets for oligotrophic lakes of ≥ 6 m annual mean Secchi disk depth, and ≥ 3 m annual minimum Secchi disk depth. See Heuff (1984) and McGarrigle et al. (2010) for some data on Secchi depth
Water quality: nutrients	$\mu\text{g/l P}$; mg/l N	Maintain/restore the concentration of nutrients in the water column to sufficiently low levels to support the habitat and its typical species	Lake habitat 3130 is associated with high water quality, with naturally low dissolved nutrients. It is naturally more productive than lake habitat 3110, probably reflecting higher concentrations of nutrients such as calcium, rather than P alone. Lake habitat 3130 may reach favourable condition slightly above the oligotrophic boundary for nutrients, but in the absence of habitat-specific targets, the targets are WFD 'High Status' or oligotrophic (OECD, 1982). The "good-moderate" boundary is too enriched to support the habitat. Annual average total phosphorus (TP) concentration should be $\leq 10\mu\text{g/l}$ TP, average annual total ammonia concentration should be $\leq 0.040\text{mg/l N}$ and annual 95th percentile for total ammonia should be $\leq 0.090\text{mg/l N}$. See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009. Acoose, Caragh and Leane failed the target (having good nutrient status) in 2010-12 (Bradley et al., 2015). Leane failed in 2007-09 (McGarrigle et al., 2010)

Water quality: phytoplankton biomass	µg/l Chlorophyll <i>a</i>	Maintain/restore appropriate water quality to support the habitat, including high chlorophyll <i>a</i> status	Lake habitat 3130 is associated with high water quality and naturally low algal growth. As for nutrients, the targets are WFD 'High Status' or oligotrophic (OECD, 1982). The "good-moderate" boundary is too enriched to support the habitat. The average growing season (March-October) chlorophyll <i>a</i> concentration must be <5.8µg/l. The annual average chlorophyll <i>a</i> concentration should be <2.5µg/l and the annual peak chlorophyll <i>a</i> concentration should be ≤8.0µg/l. Where a lake has a chlorophyll <i>a</i> concentration that is lower than this target, there should be no decline within class, i.e. no upward trend in phytoplankton biomass. See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009. Acoose (moderate status) failed to reach high status in 2007-2009 and 2010-2012 (McGarrigle et al., 2010; Bradley et al., 2015)
Water quality: phytoplankton composition	EPA phytoplankton composition metric	Maintain/restore appropriate water quality to support the habitat, including high phytoplankton composition status	The EPA has developed a phytoplankton composition metric for nutrient enrichment of Irish lakes. As for other water quality indicators, lake habitat 3130 requires WFD high status. Caragh and Leane had high phytoplankton composition status in 2010-12, but the Upper Lake had good (Bradley et al., 2015)
Water quality: attached algal biomass	Algal cover and EPA phytobenthos metric	Maintain/restore trace/absent attached algal biomass (<5% cover) and high phytobenthos status	Nutrient enrichment can favour epiphytic and epipelic algae that can out-compete the submerged vegetation. The cover abundance of attached algae in lake habitat 3130 should, therefore, be trace/absent (<5% cover). EPA phytobenthos can be used as an indicator of changes in attached algal biomass. As for other water quality indicators, habitat 3130 requires high phytobenthos status. The Upper Lake had high phytobenthos status in 2010-12, but Acoose, Caragh and Leane had good (Bradley et al., 2015)
Water quality: macrophyte status	EPA macrophyte metric (The Free Index)	Maintain/restore high macrophyte status	Nutrient enrichment can favour more competitive submerged macrophyte species that out-compete the typical and characteristic species for the lake habitat. The EPA monitors macrophyte status for WFD purposes using the 'Free Index'. The target for lake habitat 3130 is high status or an Ecological Quality Ratio (EQR) for lake macrophytes of ≥0.90, as defined in Schedule Five of the European Communities Environmental Objectives (Surface Waters) Regulations 2009. Of the monitored lakes, Leane failed the target in 2007-2009 and 2010-2012, and Caragh in 2010-2012, having good macrophyte status (McGarrigle et al., 2010; Bradley et al., 2015)
Acidification status	pH units; mg/l	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the habitat, subject to natural processes	Acidification can impact on species abundance and composition in lake habitat 3130. Acidification reduces the abundance and reproductive capacity of <i>Najas flexilis</i> (Wingfield et al., 2004). The specific requirements of habitat 3130, in terms of water and sediment pH, alkalinity and cation concentration, have not been determined. In line with targets for <i>Najas flexilis</i> , median pH values should be greater than 7 pH units. Water and sediment alkalinity and concentrations of cations (notably calcium) should be appropriate to the habitat. The target for WFD Acidification/Alkalisiation status is high. Maximum pH should be <9.0 pH units, in line with the surface water standards. See Schedule Five of the European Communities Environmental Objectives (Surface Waters) Regulations 2009. See McGarrigle et al. (2010) and Bradley et al. (2015) for WFD acidification status in the 2007-09 and 2010-12 periods

Water colour	mg/l PtCo	Maintain appropriate water colour to support the habitat	Increased water colour and turbidity decrease light penetration and can reduce the area of available habitat for lake macrophytes, particularly at the lower euphotic depths. The primary source of increased water colour in Ireland is disturbance to peatland. No habitat-specific or national standards for water colour currently exist. Studies have shown median colour concentrations in Irish lakes of 38mg/l PtCo (Free et al., 2000) and 33mg/l PtCo (Free et al., 2006). It is likely that the water colour in all Irish lake habitats would naturally be <50mg/l PtCo. Water colour is generally <30mg/l PtCo or, more naturally, <20mg/l PtCo in lakes with habitat 3130 where the peatland in the lake's catchment is intact. Free et al. (2006) reported colour of 23mg/l and 22mg/l PtCo in Caragh and the Upper Lake, respectively
Dissolved organic carbon (DOC)	mg/l	Maintain appropriate organic carbon levels to support the habitat	Dissolved (and particulate) organic carbon (OC) in the water column is linked to water colour and acidification (organic acids). Increasing DOC in water has been documented across the Northern Hemisphere, including afforested peatland catchments in Ireland. Damage and degradation of peatland, leading to decomposition of peat is likely to be the predominant source of OC in Ireland. OC in water promotes decomposition by fungi and bacteria that, in turn, releases dissolved nutrients. The increased biomass of decomposers can also impact directly on the characteristic lake communities through shading, competition, etc.
Turbidity	Nephelometric turbidity units/ mg/l SS/ other appropriate units	Maintain appropriate turbidity to support the habitat	Turbidity can significantly affect the quantity and quality of light reaching rooted and attached vegetation and can, therefore, impact on lake habitats. The settlement of higher loads of inorganic or organic material on lake vegetation communities may also have impacts on sensitive, delicate species. Turbidity can increase as a result of re-suspension of material within the lake, higher loads entering the lake, or eutrophication. Turbidity measurement and interpretation is challenging. As a result, it is likely to be difficult to set habitat-specific targets for turbidity in lakes
Fringing habitat: area and condition	Hectares	Maintain the area and condition of fringing habitats necessary to support the natural structure and functioning of habitat 3130	Most lake shorelines have fringing habitats of reedswamp, other swamp, fen, marsh or wet woodland that intergrade with and support the structure and functions of the lake habitat. In this SAC, lake shorelines are likely to have a wide variety of fringing habitats, from wet and dry native woodland, to grassland, swamp, poor fen, heath, blanket bog and rock communities. Equally, fringing habitats are dependent on the lake, particularly its water levels, and support wetland communities and species of conservation concern. Many of the fringing wetland habitats support higher invertebrate and plant species richness than the lake habitats themselves

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

3260 Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachium* vegetation

To maintain the favourable conservation condition of Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachium* vegetation in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Kilometres	Area stable or increasing, subject to natural processes	Conservation objectives concentrate on the high conservation value sub-types of the habitat. Selection of the SAC for 3260 used a broad interpretation and the habitat's distribution and sub-types in the numerous rivers and streams have not been documented. Records for rare/threatened lotic plant and invertebrate species in the SAC indicate high conservation value. Note: rooted macrophytes should be trace/absent (<5% cover) in freshwater pearl mussel (<i>Margaritifera margaritifera</i>) habitat. The SAC overlaps with four freshwater pearl mussel SAC catchments: Caragh, Kerry Blackwater, Currane and Gearhameen (the first three are priority catchments). The freshwater pearl mussel (1029) conservation objective for this SAC and that for SAC 002173 take precedence because the mussel requires environmental conditions close to natural background levels
Habitat distribution	Occurrence	No decline, subject to natural processes	Further study is needed of Irish rivers to interpret the broad description of 3260 which covers from upland bryophyte/macroalgal dominated to lowland depositing rivers with pondweeds and starworts (European Commission, 2013). The rivers in the SAC are very variable in terms of hydrology and morphology, but all are naturally very nutrient-poor. High conservation value rivers include: those associated with waterfalls/cascades and important bryophyte and fern communities (including Killarney fern); those with rare and endemic hawkweed species, e.g. <i>Hieracium argentatum</i> in the Caragh (Rich et al., 2008); those fringed with acid grassland and <i>Wahlenbergia hederacea</i> ; those flowing into/out of lakes with lentic-type communities, e.g. <i>Pilularia globulifera</i> . Useful sources of information on plants and invertebrates include Scully (1916), Heuff and Horkan (1984) in Whitton (1984), Heuff (1987), Lockhart et al. (2012), Ni Chathain et al. (2013) and O'Connor (2015)
Hydrological regime: river flow	Metres per second	Maintain/restore appropriate hydrological regimes	High conservation value sub-types are associated with natural hydrology. A natural flow regime is required for both plant communities and channel geomorphology to be in favourable condition, exhibiting typical dynamics for the river type (Hatton-Ellis and Grieve, 2003). For many sub-types, high flows are required to maintain the substratum necessary for the characteristic species. Flow variation can be particularly important, with high and flood flows being critical to the hydromorphology. As noted above, the rivers in the SAC vary considerably in terms of their hydrology
Hydrological regime: groundwater discharge	Metres per second	Maintain appropriate hydrological regime	Even small groundwater contributions can significantly alter hydrochemistry, particularly where there is basic bedrock and/or subsoils

Substratum composition: particle size range	Millimetres	Maintain/restore appropriate substratum particle size range, quantity and quality, subject to natural process	Although many of the high conservation value sub-types are dominated by coarse substrata and bedrock, certain sub-types, notably those associated with lake inflows/outflows and peatlands, are dominated by fine substrata. The size and distribution of particles is largely determined by the river flow and geology. The chemical composition (particularly minerals and nutrients) of the substratum is also important. The quality of finer sediment particles is a notable driver for rooted plant communities
Water quality	Various	Maintain/restore appropriate water quality to support the natural structure and functioning of the habitat	The specific targets may vary among sub-types. The rivers within the SAC are considered to be naturally very nutrient-poor and, therefore, to typically require Water Framework Directive (WFD) high status, in terms of nutrient and oxygenation standards, and EQRs (Ecological Quality Ratios) for macroinvertebrates and phytobenthos. Rivers dominated by bryophytes and macroalgae, in particular, typically require WFD high status. High status targets apply to freshwater pearl mussel (<i>Margaritifera margaritifera</i>) habitat in the Caragh, Kerry Blackwater, Currane and Gearhameen (see The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009). See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009, Environmental Protection Agency (EPA) river water quality reports (e.g. Bradley et al., 2015) and Ní Chatháin et al. (2013)
Typical species	Occurrence	Typical species of the relevant habitat sub-type should be present and in good condition	The sub-types of this habitat are poorly understood and their typical species have not yet been fully defined. The typical species may include higher plants, bryophytes, macroalgae and microalgae, and invertebrates. As noted above, a number of rare and/or protected species are associated with the rivers in the SAC, including Killarney fern (<i>Trichomanes speciosum</i>), silver hawkweed (<i>Hieracium argentatum</i>), ivy-leaved bellflower (<i>Wahlenbergia hederacea</i>), pillwort (<i>Pilularia globulifera</i>) and the caddisflies <i>Hydroptila tigurina</i> and <i>Lepidostoma basale</i> . See also the conservation objective for Killarney fern (<i>Trichomanes speciosum</i>) in this volume
Floodplain connectivity: area	Hectares	The area of active floodplain at and upstream of the habitat should be maintained	River connectivity with the floodplain is important for the functioning of this habitat. Channels with a naturally functioning floodplain are better able to maintain habitat and water quality (Hatton-Ellis and Grieve, 2003). Floodplain connectivity is particularly important in terms of sediment sorting and nutrient deposition. High conservation value rivers are intimately connected to floodplain habitats and function as important wildlife corridors, connecting otherwise isolated or fragmented habitats in the wider countryside (Hatton-Ellis and Grieve, 2003; Mainstone et al., 2016)

Riparian habitat: Hectares
area and condition

Maintain the area and
condition of fringing
habitats necessary to
support the habitat and its
sub-types

Riparian habitats (including those along lake shores), particularly natural/semi-natural woodlands and wetlands, are an integral part of the structure and functioning of river systems, even where they do not form part of a natural floodplain. Fringing habitats can contribute to the aquatic food web (e.g. allochthonous matter such as leaf fall), provide habitat (refuge and resources) for certain life-stages of fish, birds and aquatic invertebrates, assist in the settlement of fine suspended material, protect banks from erosion and contribute to nutrient cycling. Shade may also be important in suppressing algal growth in enriched rivers and moderating temperatures. Equally, fringing habitats are dependent on rivers/lakes, particularly their water levels, and support wetland communities and species of conservation concern. See Mainstone et al. (2016). Alluvial and riparian woodland, semi-natural grassland and peatland are important for the rivers in this SAC

Conservation Objectives for : Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC [000365]

4010 Northern Atlantic wet heaths with *Erica tetralix*

To restore the favourable conservation condition of Northern Atlantic wet heaths with *Erica tetralix* in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Northern Atlantic wet heaths with <i>Erica tetralix</i> has not been mapped in detail for Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, but from current available data the total area of the qualifying habitat is estimated to be approximately 12,846ha, covering 17% of the SAC (NPWS internal files). Further details on this and the following attributes can be found in the Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC conservation objectives supporting document for blanket bogs and associated habitats
Habitat distribution	Occurrence	No decline, subject to natural processes	The habitat is documented to occur on hillsides throughout the SAC where it often occurs in a mosaic with blanket bog habitat (Barron and Perrin, 2011; NPWS internal files). Further information can be found within Barron and Perrin (2011), NPWS internal files and the blanket bogs and associated habitats supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil nutrient status within natural range	See the blanket bogs and associated habitats supporting document for further details
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	A variety of wet heath vegetation communities have been recorded in this SAC (Roche et al., 2012; NPWS internal files), six of which correspond to communities recorded in the National Survey of Upland Habitats and listed in the provisional list of vegetation communities described in Perrin et al. (2014). Further information on vegetation communities associated with this habitat is presented in Perrin et al. (2014)
Vegetation composition: cross-leaved heath	Occurrence within 20m of a representative number of monitoring stops	Cross-leaved heath (<i>Erica tetralix</i>) present within a 20m radius of each monitoring stop	Attribute and target based on Perrin et al. (2014)
Vegetation composition: positive indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of positive indicator species at least 50%	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is also presented
Vegetation composition: lichens and bryophytes	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of <i>Cladonia</i> and <i>Sphagnum</i> species, <i>Racomitrium lanuginosum</i> and pleurocarpous mosses at least 10%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: ericoid species and crowberry	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of ericoid species and crowberry (<i>Empetrum nigrum</i>) at least 15%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: dwarf shrub species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of dwarf shrubs less than 75%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 1%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species for this habitat is also presented

Vegetation composition: non-native species	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014). <i>Rhododendron</i> (<i>Rhododendron ponticum</i>) has been recorded in this habitat in the SAC (Roche et al., 2012; NPWS internal files)
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 20%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: bracken	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of bracken (<i>Pteridium aquilinum</i>) less than 10%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: soft rush	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of soft rush (<i>Juncus effusus</i>) less than 10%	Attribute and target based on Perrin et al. (2014)
Vegetation structure: <i>Sphagnum</i> condition	Condition at a representative number of 2m x 2m monitoring stops	Less than 10% of the <i>Sphagnum</i> cover is crushed, broken and/or pulled up	Attribute and target based on Perrin et al. (2014)
Vegetation structure: signs of browsing	Percentage of shoots browsed at a representative number of 2m x 2m monitoring stops	Less than 33% collectively of the last complete growing season's shoots of ericoids, crowberry (<i>Empetrum nigrum</i>) and bog-myrtle (<i>Myrica gale</i>) showing signs of browsing	Attribute and target based on Perrin et al. (2014)
Vegetation structure: burning	Occurrence in local vicinity of a representative number of monitoring stops	No signs of burning in sensitive areas, into the moss, liverwort or lichen layer or exposure of peat surface due to burning	Attribute and target based on Perrin et al. (2014), where the list of sensitive areas for this habitat is also presented
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014)
Physical structure: drainage	Percentage area in local vicinity of a representative number of monitoring stops	Area showing signs of drainage from heavy trampling, tracking or ditches less than 10%	Attribute and target based on Perrin et al. (2014)
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat and no decline in status of hepatic mats associated with this habitat	This includes species listed in the Flora (Protection) Order, 2015 and/or the red data lists (Lockhart et al., 2012; Wyse Jackson et al., 2016). Hepatic mats occur within this habitat in the SAC (R. Hodd, pers. comm.)

Conservation Objectives for : Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC [000365]

4030 European dry heaths

To restore the favourable conservation condition of European dry heaths in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	European dry heaths has not been mapped in detail for Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, but from current available data the total area of the qualifying habitat is estimated to be approximately 6,894ha, covering 9% of the SAC (NPWS internal files). Further details on this and the following attributes can be found in the Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC conservation objectives supporting document for blanket bogs and associated habitats
Habitat distribution	Occurrence	No decline, subject to natural processes	The habitat is best represented in the eastern part of the SAC, including much of The Paps, Tomies Mountain, Shehy Mountain, Purple Mountain and the southern slopes of the Owenreagh valley (Barron and Perrin, 2011; NPWS internal files). It also dominates some of the hills at the western edge of the SAC near the coast (NPWS internal files). Further information can be found within Barron and Perrin (2011), NPWS internal files and the blanket bogs and associated habitats supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil nutrient status within natural range	See the blanket bogs and associated habitats supporting document for further details
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Roche et al. (2012) recorded a variety of dry heath vegetation communities in this SAC, three of which correspond to communities recorded in the National Survey of Upland Habitats and listed in the provisional list of vegetation communities described in Perrin et al. (2014). Further information on vegetation communities associated with this habitat is presented in Perrin et al. (2014)
Vegetation composition: lichens and bryophytes	Number of species at a representative number of 2m x 2m monitoring stops	Number of bryophyte or non-crustose lichen species present at each monitoring stop is at least three, excluding <i>Campylopus</i> and <i>Polytrichum</i> mosses	Attribute and target based on Perrin et al. (2014)
Vegetation composition: number of positive indicator species	Number of species at a representative number of 2m x 2m monitoring stops	Number of positive indicator species present at each monitoring stop is at least two	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat, which is composed of dwarf shrubs, is also presented
Vegetation composition: cover of positive indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of positive indicator species at least 50% for siliceous dry heath and 50-75% for calcareous dry heath	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat, which is composed of dwarf shrubs, is also presented
Vegetation composition: dwarf shrub composition	Percentage cover at a representative number of 2m x 2m monitoring stops	Proportion of dwarf shrub cover composed collectively of bog-myrtle (<i>Myrica gale</i>), creeping willow (<i>Salix repens</i>) and western gorse (<i>Ulex gallii</i>) is less than 50%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 1%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species for this habitat is also presented

Vegetation composition: non-native species	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014). <i>Rhododendron (Rhododendron ponticum)</i> has been recorded in this habitat in the SAC (Barron and Perrin, 2011)
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 20%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: bracken	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of bracken (<i>Pteridium aquilinum</i>) less than 10%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: soft rush	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of soft rush (<i>Juncus effusus</i>) less than 10%	Attribute and target based on Perrin et al. (2014)
Vegetation structure: senescent ling	Percentage cover at a representative number of 2m x 2m monitoring stops	Senescent proportion of ling (<i>Calluna vulgaris</i>) cover less than 50%.	Attribute and target based on Perrin et al. (2014)
Vegetation structure: signs of browsing	Percentage of shoots browsed at a representative number of 2m x 2m monitoring stops	Less than 33% collectively of the last complete growing season's shoots of ericoids and crowberry (<i>Empetrum nigrum</i>) showing signs of browsing	Attribute and target based on Perrin et al. (2014)
Vegetation structure: burning	Occurrence in local vicinity of a representative number of monitoring stops	No signs of burning in sensitive areas	Attribute and target based on Perrin et al. (2014), where the list of sensitive areas for this habitat is also presented
Vegetation structure: growth phases of ling	Percentage cover in local vicinity of a representative number of monitoring stops	Outside sensitive areas, all growth phases of ling (<i>Calluna vulgaris</i>) should occur throughout, with at least 10% of cover in the mature phase	Attribute and target based on Perrin et al. (2014), where the list of sensitive areas for this habitat is also presented
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014)
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species listed in the Flora (Protection) Order, 2015 (FPO) and/or the red data lists (Lockhart et al., 2012; Wyse Jackson et al., 2016). The FPO listed and Near Threatened Kerry lily (<i>Simethis mattiazzii</i>) (Wyse Jackson et al., 2016) has been recorded from dry heath within the SAC (NPWS internal files)

Conservation Objectives for : Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC [000365]

4060 Alpine and Boreal heaths

To restore the favourable conservation condition of Alpine and Boreal heaths in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Alpine and Boreal heaths has not been mapped in detail for Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, but from current available data the total area of the qualifying habitat is estimated to be approximately 1,258ha, covering 2% of this SAC (NPWS internal files). Further details on this and the following attributes can be found in the Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC conservation objectives supporting document for blanket bogs and associated habitats
Habitat distribution	Occurrence	No decline, subject to natural processes	The habitat is documented to occur on most of the higher mountains and ridges within the SAC. Good examples are present on Mangerton Mountain, Purple Mountain and parts of the Macgillicuddy's Reeks (Barron and Perrin, 2011; NPWS internal files). Further information can be found within Barron and Perrin (2011), NPWS internal files and the blanket bogs and associated habitats supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil nutrient status within natural range	See the blanket bogs and associated habitats supporting document for further details
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Roche et al. (2012) recorded Alpine and Boreal heath vegetation communities in this SAC, one of which corresponds to a community recorded in the National Survey of Upland Habitats and listed in the provisional list of vegetation communities described in Perrin et al. (2014). Further information on vegetation communities associated with this habitat is presented in Perrin et al. (2014)
Vegetation composition: lichens and bryophytes	Number of species at a representative number of 2m x 2m monitoring stops	Number of bryophyte or non-crustose lichen species present at each monitoring stop is at least three	Attribute and target based on Perrin et al. (2014)
Vegetation composition: positive indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of positive indicator species at least 66%	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is also presented
Vegetation composition: dwarf shrub species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of dwarf shrub species at least 10%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 10%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species for this habitat is also presented
Vegetation composition: non-native species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014)
Vegetation structure: signs of grazing	Percentage of leaves grazed at a representative number of 2m x 2m monitoring stops	Less than 10% collectively of the live leaves of specific graminoids showing signs of grazing	Attribute and target based on Perrin et al. (2014). See the blanket bogs and associated habitats supporting document for the list of specific graminoids

Vegetation structure: signs of browsing	Percentage of shoots browsed at a representative number of 2m x 2m monitoring stops	Less than 33% collectively of the last complete growing season's shoots of ericoids and crowberry (<i>Empetrum nigrum</i>) showing signs of browsing	Attribute and target based on Perrin et al. (2014)
Vegetation structure: burning	Occurrence in local vicinity of a representative number of monitoring stops	No signs of burning within the habitat	Attribute and target based on Perrin et al. (2014)
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014)
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat and no decline in status of hepatic mats associated with this habitat	This includes species listed in the Flora (Protection) Order, 2015 and/or the red data lists (Lockhart et al., 2012; Wyse Jackson et al., 2016). Hepatic mats occur within this habitat in the SAC (R. Hodd, pers. comm.)

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

5130 *Juniperus communis* formations on heaths or calcareous grasslands

To maintain the favourable conservation condition of *Juniperus communis* formations on heaths or calcareous grasslands in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	The area of <i>Juniperus communis</i> formations on heaths or calcareous grasslands within Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC is currently unknown. The habitat is documented to occur on islands in the Upper Lake and on headlands of the Muckross peninsula within the SAC (NPWS internal files). Cooper et al. (2012) identified nine locations of juniper (<i>Juniperus communis</i>) vegetation (KY03-KY11) during a national juniper survey, although none were classified as formations (see below). Barron and Perrin (2011) also recorded juniper plants within the National Park. NB unsurveyed areas may be present within the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes	See note for habitat area above. It is important to note that unsurveyed areas may be present within the SAC
Juniper population size	Number per formation	At least 50 plants per formation	To classify as a juniper (<i>Juniperus communis</i>) formation, at least 50 plants should be present (Cooper et al., 2012)
Vegetation composition: typical species	Number per formation	At least 50% of the listed positive indicator species for the relevant vegetation group present	Attribute and target based on Cooper et al. (2012), where positive indicator species for five vegetation groups are listed
Vegetation composition: negative indicator species	Occurrence per formation	Negative indicator species, particularly non-native invasive species, absent or under control	Attribute and target based on Cooper et al. (2012), where the list of negative indicator species is presented
Vegetation structure: cone-bearing plants	Percentage per formation	At least 10% of plants are bearing cones	Attribute and target based on Cooper et al. (2012)
Vegetation structure: seedling recruitment	Percentage per formation	At least 10% of juniper plants are seedlings	Attribute and target based on Cooper et al. (2012)
Vegetation structure: dead juniper	Percentage per formation	Mean percentage of each juniper plant dead less than 10%	Attribute and target based on Cooper et al. (2012)

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

6130 Calaminarian grasslands of the *Violetalia calaminariae*

To maintain the favourable conservation condition of Calaminarian grasslands of the *Violetalia calaminariae* in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	No decline, subject to natural processes	Calaminarian grasslands of the <i>Violetalia calaminariae</i> habitat has been recorded at two locations within Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC: at Muckross Lake, where the area of the habitat is estimated to be 0.16ha, and at Ross Island, where the area of the habitat is estimated to be 0.15ha (Holyoak, 2009). NB further unsurveyed areas may be present within the SAC
Distribution	Location	No decline, subject to natural processes. See map 4 for recorded locations	Calaminarian grassland occurs at the disused copper mine on the north shore of Muckross Lake and at Ross Island, at a former copper and lead mine (Holyoak, 2009). NB further unsurveyed areas may be present within the SAC
Physical structure: bare ground	Percentage cover	Maintain adequate open ground	At Muckross Lake, calaminarian grassland is well-developed over most of the open spoil area. The extent of bare soil and rock within four (50cm x 50cm) quadrats (in 2008) ranged between 0% and 50% (Holyoak, 2009). At Ross Island, calaminarian grassland is well-developed in small open areas above regular wave-washing of Lough Leane and below the woodland edge. The extent of bare soil and rock within two (50cm x 50cm) quadrats (in 2008) ranged between 4% and 50% (Holyoak, 2009)
Soil toxicity: copper content	µg Cu/g dry weight soil	Maintain high copper (Cu) levels in soil	Total copper content in a sample of mine spoil taken from Ross Island in 2009 was 3,815µg/g dry weight (Campbell, 2013). Mine spoil with similar vegetation from Cornwall had available copper of 151–3,220µg/g dry weight (Holyoak et al., 2000; Walsh, 2001)
Vegetation structure: height and cover	Centimetres; percentage cover	Maintain low and open vegetation	At Muckross Lake, within four (50cm x 50cm) quadrats, herbaceous vegetation height was relatively short (4-8cm) and vegetation cover was 34–75%. Bryophyte cover was relatively high (0-80%). Within two (50cm x 50cm) quadrats at Ross Island, herbaceous vegetation height was 4-10cm, vegetation cover was relatively low (26-50%) and bryophyte cover was 11-25%
Vegetation composition: metallophyte bryophytes	Number	Maintain diversity and populations of metallophyte bryophytes	<i>Cephaloziella massalongi</i> , a liverwort listed on the Flora (Protection) Order, 2015 and classified as Vulnerable (Lockhart et al., 2012) occurs at both Muckross Lake and Ross Island (Holyoak, 2009). The Near Threatened liverwort <i>Cephaloziella stellulifera</i> (Lockhart et al., 2012) also occurs at Muckross Lake (Holyoak, 2009)

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)

To restore the favourable conservation condition of *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, with a minimum area of 9.02ha. See map 4	The full extent of <i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) within Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC is unknown. <i>Molinia</i> meadows habitat was recorded as part of the Irish Semi-natural Grassland Survey (ISGS) within the sub-site Bunrower (ISGS site code 2403) (Devaney et al., 2013; O'Neill et al., 2013) with an area of 8.03ha. In the production of a habitat map for Killarney National Park, Barron and Perrin (2011) mapped a further 0.98ha of the habitat at Ross Island to give a total minimum area of 9.02ha of <i>Molinia</i> meadows in the SAC. Map 4 shows surveyed grasslands, including the areas classified as 6410 (9.02ha). NB further unsurveyed areas may be present within the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 4	Distribution based on Barron and Perrin (2011) and O'Neill et al. (2013). It is important to note that further unsurveyed areas may be present within the SAC
Vegetation composition: positive indicator species	Number at a representative number of monitoring stops	At least seven positive indicator species present, including one "high quality" species as listed in O'Neill et al. (2013)	Based on O'Neill et al. (2013), where the list of positive indicator species, including high quality species, is also presented. Note that purple moor-grass (<i>Molinia caerulea</i>) is a positive indicator species, but not necessarily an essential component of the habitat. See Devaney et al. (2013) and O'Neill et al. (2013) for further details
Vegetation composition: negative indicator species	Percentage at a representative number of monitoring stops	Negative indicator species collectively not more than 20% cover, with cover by an individual species not more than 10%	Attribute and target based on O'Neill et al. (2013), where the list of negative indicator species is also presented
Vegetation composition: non-native species	Percentage at a representative number of monitoring stops	Cover of non-native species not more than 1%	Attribute and target based on O'Neill et al. (2013)
Vegetation composition: moss species	Percentage at a representative number of monitoring stops	Hair mosses (<i>Polytrichum</i> spp.) not more than 25% cover	Attribute and target based on O'Neill et al. (2013)
Vegetation composition: woody species and bracken	Percentage at a representative number of monitoring stops	Cover of woody species and bracken (<i>Pteridium aquilinum</i>) not more than 5% cover	Attribute and target based on O'Neill et al. (2013)
Vegetation structure: broadleaf herb:grass ratio	Percentage at a representative number of monitoring stops	Broadleaf herb component of vegetation between 40% and 90%	Attribute and target based on O'Neill et al. (2013)
Vegetation structure: sward height	Percentage at a representative number of monitoring stops	At least 30% of sward between 10cm and 80cm tall	Attribute and target based on O'Neill et al. (2013)
Vegetation structure: litter	Percentage at a representative number of monitoring stops	Litter cover not more than 25%	Attribute and target based on O'Neill et al. (2013)
Physical structure: bare ground	Percentage	Not more than 10% bare ground	Attribute and target based on O'Neill et al. (2010)

Physical structure: bare soil	Percentage at a representative number of monitoring stops	Not more than 10% bare soil	Attribute and target based on O'Neill et al. (2013)
Physical structure: disturbance	Square metres	Area showing signs of serious grazing or other disturbance less than 20m ²	Attribute and target based on O'Neill et al. (2013)

Conservation Objectives for : Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC [000365]

7130 Blanket bogs (* if active bog)

To restore the favourable conservation condition of Blanket bogs (* if active bog) in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Blanket bog has not been mapped in detail for Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, but from current available data the total area of the qualifying habitat is estimated to be approximately 6,445ha, covering 8% of this SAC (NPWS internal files). Further details on this and the following attributes can be found in the Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC conservation objectives supporting document for blanket bogs and associated habitats
Habitat distribution	Occurrence	No decline, subject to natural processes	This habitat is documented to occur in both lowland and upland situations within the SAC. Examples of lowland blanket bogs include Cumberagh River Bog, Ballygisheen Bog, Eirk Bog, Dinis Bog, Newfoundland Bog, Meelagh River Bog and Cores Bog. Examples of upland blanket bogs include Coomacheo Bog, Caherbarnagh Bog, Carrig East Bog, Tooreenbreanla Bog, Tooreenealagh Bog, Mangerton Bog, Lough Nambrackdarrig Bog and Oolagh East Bog. Further information can be found within Douglas et al. (1989), Mooney et al. (1991), Barron and Perrin (2011), NPWS internal files and the blanket bogs and associated habitats supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil nutrient status within natural range	See the blanket bogs and associated habitats supporting document for further details
Ecosystem function: peat formation	Active blanket bog as a proportion of the total area of Annex I blanket bog habitat	At least 99% of the total Annex I blanket bog area is active	See the blanket bogs and associated habitats supporting document for further details
Ecosystem function: hydrology	Flow direction, water levels, occurrence of drains and erosion gullies	Natural hydrology unaffected by drains and erosion	Further details and a brief discussion of restoration potential is presented in the blanket bogs and associated habitats supporting document
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Douglas et al. (1989), Mooney et al. (1991) and Roche et al. (2012) recorded a variety of blanket bog vegetation communities in this SAC, seven of which correspond to communities recorded in the National Survey of Upland Habitats and listed in the provisional list of vegetation communities described in Perrin et al. (2014). Further information on vegetation communities associated with this habitat is presented in Perrin et al. (2014)
Vegetation composition: positive indicator species	Number of species at a representative number of 2m x 2m monitoring stops	Number of positive indicator species present at each monitoring stop is at least seven	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is also presented
Vegetation composition: lichens and bryophytes	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of bryophytes or lichens, excluding <i>Sphagnum fallax</i> , at least 10%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: potential dominant species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of each of the potential dominant species less than 75%	Attribute and target based on Perrin et al. (2014). See the blanket bogs and associated habitats supporting document for the list of potential dominant species

Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 1%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species for this habitat is also presented
Vegetation composition: non-native species	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014). Rhododendron (<i>Rhododendron ponticum</i>) and the non-native moss <i>Campylopus introflexus</i> have been recorded in this habitat in the SAC (Roche et al., 2012)
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 10%	Attribute and target based on Perrin et al. (2014)
Vegetation structure: <i>Sphagnum</i> condition	Condition at a representative number of 2m x 2m monitoring stops	Less than 10% of the <i>Sphagnum</i> cover is crushed, broken and/or pulled up	Attribute and target based on Perrin et al. (2014)
Vegetation structure: signs of browsing	Percentage of shoots browsed at a representative number of 2m x 2m monitoring stops	Last complete growing season's shoots of ericoids, crowberry (<i>Empetrum nigrum</i>) and bog-myrtle (<i>Myrica gale</i>) showing signs of browsing collectively less than 33%	Attribute and target based on Perrin et al. (2014)
Vegetation structure: burning	Occurrence in local vicinity of a representative number of monitoring stops	No signs of burning in sensitive areas, into the moss, liverwort or lichen layer or exposure of peat surface due to burning	Attribute and target based on Perrin et al. (2014), where the list of sensitive areas for this habitat is also presented
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014)
Physical structure: drainage	Percentage area in local vicinity of a representative number of monitoring stops	Area showing signs of drainage from heavy trampling, tracking or ditches less than 10%	Attribute and target based on Perrin et al. (2014)
Physical structure: erosion	Percentage area in local vicinity of a representative number of monitoring stops	Less than 5% of the greater bog mosaic comprises erosion gullies and eroded areas	Attribute and target based on Perrin et al. (2014)
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species listed in the Flora (Protection) Order, 2015 (FPO) and/or the red data lists (Lockhart et al., 2012; Wyse Jackson et al., 2016). The Near Threatened brown beak-sedge (<i>Rhynchospora fusca</i>) (Wyse Jackson et al., 2016) was recorded in blanket bog in the SAC (Roche et al., 2012). The FPO listed and Near Threatened slender cottongrass (<i>Eriophorum gracile</i>) (Wyse Jackson et al., 2016) has been recorded within the SAC (NPWS internal files), but this species cannot be assigned specifically to blanket bog

Conservation Objectives for : Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC [000365]

7150 Depressions on peat substrates of the Rhynchosporion

To restore the favourable conservation condition of Depressions on peat substrates of the Rhynchosporion in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Depressions on peat substrates of the Rhynchosporion has not been mapped in detail for Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC and thus the total area of the qualifying habitat in the SAC is unknown. Further details on this and the following attributes can be found in the Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC conservation objectives supporting document for blanket bogs and associated habitats
Habitat distribution	Occurrence	No decline, subject to natural processes	This habitat typically occurs in the wetter areas of lowland blanket bog in the SAC. Good examples are present at Ballygisheen Bog, Cores Bog, Oak Island Bog, Dinis Bog, Cumberagh River Bog, Meelagh River Bog, Looscaunagh Bog and Kealduff River Bog. Further information can be found within Douglas et al. (1989), Mooney et al. (1991), Barron and Perrin (2011), Roche et al. (2012) and the blanket bogs and associated habitats supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil nutrient status within natural range	See the blanket bogs and associated habitats supporting document for further details
Vegetation composition: positive indicator species	Number of species at a representative number of 2m x 2m monitoring stops	Number of positive indicator species at each monitoring stop is at least five	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is also presented
Vegetation composition: <i>Rhynchospora</i> spp.	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of white beaked sedge (<i>Rhynchospora alba</i>) and brown beaked sedge (<i>R. fusca</i>) at least 10%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: potential dominant species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of each of the potential dominant species individually less than 35%	Attribute and target based on Perrin et al. (2014). See the blanket bogs and associated habitats supporting document for the list of potential dominant species
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 1%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species for this habitat is also presented
Vegetation composition: non-native species	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 10%	Attribute and target based on Perrin et al. (2014)
Vegetation structure: <i>Sphagnum</i> condition	Condition at a representative number of 2m x 2m monitoring stops	Less than 10% of the <i>Sphagnum</i> cover is crushed, broken and/or pulled up	Attribute and target based on Perrin et al. (2014)

Vegetation structure: signs of browsing	Percentage of shoots browsed at a representative number of 2m x 2m monitoring stops	Last complete growing season's shoots of ericoids, crowberry (<i>Empetrum nigrum</i>) and bog-myrtle (<i>Myrica gale</i>) showing signs of browsing collectively less than 33%	Attribute and target based on Perrin et al. (2014)
Vegetation structure: burning	Occurrence in local vicinity of a representative number of monitoring stops	No signs of burning in sensitive areas, into the moss, liverwort or lichen layer or exposure of peat surface due to burning	Attribute and target based on Perrin et al. (2014), where the list of sensitive areas for this habitat is also presented
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014)
Physical structure: drainage	Percentage area in local vicinity of a representative number of monitoring stops	Area showing signs of drainage from heavy trampling, tracking or ditches less than 10%	Attribute and target based on Perrin et al. (2014)
Physical structure: erosion	Percentage area in local vicinity of a representative number of monitoring stops	Less than 5% of the greater bog mosaic comprises erosion gullies and eroded areas	Attribute and target based on Perrin et al. (2014)
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species listed in the Flora (Protection) Order, 2015 and/or the red data lists (Lockhart et al., 2012; Wyse Jackson et al., 2016). The Near Threatened brown beak-sedge (<i>Rhynchospora fusca</i>) (Wyse Jackson et al., 2016) was recorded in this habitat in the SAC (Roche et al., 2012)

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles

To restore the favourable conservation condition of Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, with a minimum area of 1,254.4ha. See maps 5 and 6	Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC holds the most extensive areas of old oak woodland in Ireland. Several sites within the SAC were surveyed by Perrin et al. (2008) as part of the National Survey of Native Woodlands (NSNW) - NSNW site codes 1270, 1277, 1289, 1290, 1292, 1495, 1715, 1734, 1736, 1737, 1793 and 2013, with a combined mapped area of 461.6ha. NSNW sites 1277, 1290 and 1737 were included in a national monitoring survey (O'Neill and Barron, 2013). In the production of a habitat map for Killarney National Park, Barron and Perrin (2011) mapped a further 792.8ha of the habitat within the National Park to give a total minimum area of 1,254.4ha of old sessile oak woods within the SAC. Map 5 (the west of the SAC) and map 6 (east) show the mapped woodlands in the SAC, including the areas classified as 91A0 (1,254.4ha). It is important to note that further unsurveyed areas may be present within the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes. The mapped woodland locations are shown on maps 5 and 6	Distribution based on Perrin et al. (2008) and Barron and Perrin (2011). It is important to note that further unsurveyed areas may be present within the SAC
Woodland size	Hectares	Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	The target areas for individual woodlands aim to reduce habitat fragmentation and benefit those species requiring 'deep' woodland conditions (Peterken, 2002). In some cases, topographical constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008) and NPWS internal files
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008) and NPWS internal files. See also Kelly (1981)
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Oak (<i>Quercus petraea</i>) generally regenerates poorly. In suitable sites, ash (<i>Fraxinus excelsior</i>) can regenerate in large numbers although few seedlings reach pole size
Woodland structure: dead wood	m ³ per hectare; number per hectare	At least 30m ³ /ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms, Kerry slug (<i>Geomalacus maculosus</i>) and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources

Woodland structure: indicators of local distinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red data and other rare or localised species. Perrin and Daly (2010) identify 3 sub-sites, Tomies Wood (NSNW site code 1289), Derrycunihy Wood (1290) and Camillan Wood (1495), as ancient woodland and Drom East (1734) as possible ancient woodland. Atlantic and Lusitanian flora is well-developed in the habitat in the SAC with species such as strawberry tree (<i>Arbutus unedo</i>), Irish spurge (<i>Euphorbia hyberna</i>), kidney saxifrage (<i>Saxifraga hirsuta</i>) and St. Patrick's cabbage (<i>S. spathularis</i>). Many rare and protected bryophytes occur, e.g. the Endangered <i>Cephalozia crassifolia</i> , the Vulnerable <i>Lejeunea flava</i> subsp. <i>moorei</i> and the Near Threatened <i>Radula carringtonii</i> (Lockhart et al., 2012), all of which are listed on the Flora (Protection) Order, 2015. See also Breen (2014) and the conservation objective for Kerry slug (1024)
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008) and NPWS internal files
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including oak (<i>Quercus petraea</i>) and birch (<i>Betula pubescens</i>)	Species reported in Perrin et al. (2008) and NPWS internal files
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	The following are the most common non-native invasive species in this woodland type: beech (<i>Fagus sylvatica</i>), sycamore (<i>Acer pseudoplatanus</i>) and rhododendron (<i>Rhododendron ponticum</i>). Rhododendron infestation is a problem within this habitat in the SAC, but a programme of removal is on-going, particularly within the boundaries of Killarney National Park (Barron and Perrin, 2011; NPWS internal files). Beech has been reported from Rossacroonalo (NSNW site code 1270), Tomies Wood (1289) and Camillan Wood (1495) (Perrin et al., 2008). A small amount of Japanese knotweed (<i>Fallopia japonica</i>) was noted from Oolagh East (NSNW site code 1736) (Perrin et al., 2008)

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)

To restore the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)* in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, with a minimum area of 170.84ha. See map 6	Alluvial woods* in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC are found on the low-lying limestone areas within the floodplain of Lough Leane and also in association with streams or calcareous springs such as at Cloghereen Pool Wood, the woodland behind Muckcross Abbey, Carrigafreaghane Wood and Bellview Wood (Barron and Perrin, 2011). This habitat was surveyed by Perrin et al. (2008) as part of the National Survey of Native Woodlands (NSNW) at Game Wood (NSNW site code 1288) and mapped as 32.24ha. Game Wood was also included in a national monitoring survey (O'Neill and Barron, 2013). In the production of a habitat map for Killarney National Park, Barron and Perrin (2011) mapped a further 138.6ha of the habitat within the National Park to give a total minimum area of 170.84ha of alluvial woods within the SAC. Map 6 shows mapped woodlands, including the area classified as 91E0* (170.84ha). NB further unsurveyed areas may be present within the SAC
Habitat distribution	Occurrence	No decline. The mapped woodland locations are shown on map 6	Distribution based on Perrin et al. (2008) and Barron and Perrin (2011). NB further unsurveyed areas may be present within the SAC
Woodland size	Hectares	Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	The target areas for individual woodlands aim to reduce habitat fragmentation and benefit those species requiring 'deep' woodland conditions (Peterken, 2002). In some cases, topographical constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008) and NPWS internal files. See also Kelly and Iremonger (1997)
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008) and NPWS internal files. See also Kelly and Iremonger (1997)
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Alder (<i>Alnus glutinosa</i>) and oak (<i>Quercus</i> spp.) tend to regenerate poorly. Ash (<i>Fraxinus excelsior</i>) often regenerates in large numbers although few seedlings reach pole size
Hydrological regime: flooding depth/height of water table	Metres	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	Periodic flooding is essential to maintain alluvial woodlands along river and lake floodplains, but not for woodland around springs/seepage areas

Woodland structure: dead wood	m ³ per hectare; number per hectare	At least 30m ³ /ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter (greater than 20cm diameter in the case of alder (<i>Alnus glutinosa</i>))	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources
Woodland structure: indicators of local distinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands (see Perrin and Daly, 2010), archaeological and geological features as well as red data and other rare or localised species
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008) and NPWS internal files. See also Kelly and Iremonger (1997)
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including alder (<i>Alnus glutinosa</i>), willows (<i>Salix</i> spp.), oak (<i>Quercus</i> spp.), ash (<i>Fraxinus excelsior</i>) and birch (<i>Betula pubescens</i>)	Species reported in Perrin et al. (2008) and NPWS internal files. See also Kelly and Iremonger (1997)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	Sycamore (<i>Acer pseudoplatanus</i>) has been reported from Bellview Wood (NPWS internal files) and Game Wood (NSNW site code 1288), where beech (<i>Fagus sylvatica</i>) also occurs (Perrin et al., 2008). Rhododendron (<i>Rhododendron ponticum</i>) also occurs in the habitat in the SAC, but is being controlled (NPWS internal files). Rhododendron forms clumps in parts of Game Wood (NSNW site code 1288), but its spread is somewhat curtailed by the wet substrate (Perrin et al., 2008)

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

91J0 *Taxus baccata* woods of the British Isles

To restore the favourable conservation condition of *Taxus baccata* woods of the British Isles* in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, with a minimum area of 73.46ha. See map 6	<i>Taxus baccata</i> woods of the British Isles* in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC occur on the limestone areas of Muckross Peninsula and comprise the only sizeable stands of yew (<i>Taxus baccata</i>) in Ireland. The main area is at Reenadinna, with smaller significant stands at Monk's Wood and Dundag Point. Yew woodland was surveyed in the SAC by Perrin et al. (2008) as part of the National Survey of Native Woodlands (NSNW) at Reenadinna Wood (NSNW site code 1291) and mapped as 38.63ha. Reenadinna was also included in a national monitoring survey (Cross and Lynn, 2013). In the production of a habitat map for Killarney National Park, Barron and Perrin (2011) mapped a further 34.83ha of the habitat within the National Park to give a total minimum area of 73.46ha of yew woods within the SAC. Map 6 shows the mapped woodlands, including the areas classified as 91J0* (73.46ha). NB further unsurveyed areas may be present within the SAC
Habitat distribution	Occurrence	No decline. The mapped woodland locations are shown on maps 6	Distribution based on Perrin et al. (2008), Barron and Perrin (2011) and Cross and Lynn (2013). NB further unsurveyed areas may be present within the SAC
Woodland size	Hectares	Area stable or increasing	The yew woods of the Muckross peninsula are unlikely to spread due to the limited extent of the limestone (NPWS internal files)
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and herb and bryophyte layer	Described in Perrin et al. (2008), Cross and Lynn (2013) and NPWS internal files. At Reenadinna, the shrub and herbaceous layers are poorly developed. Where exclosures were put in place in 2001 to exclude grazing, regeneration of ivy (<i>Hedera helix</i>), bramble (<i>Rubus fruticosus</i> agg.) and holly (<i>Ilex aquifolium</i>) is taking place (Perrin et al., 2011; Cross and Lynn, 2013)
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al., (2008), Cross and Lynn (2013) and NPWS internal files. See also Kelly (1981)
Woodland structure: natural regeneration	Seedling: sapling: pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Yew (<i>Taxus baccata</i>) regenerates poorly under its own canopy, but can regenerate under a canopy of other species or in the open if the competition from the field layer is not too strong. Overgrazing, mostly by the non-native sika deer (<i>Cervus nippon</i>), but also by native red deer (<i>C. elaphus</i>), is a factor in the lack of regeneration at Reenadinna (Perrin et al., 2011; Cross and Lynn, 2013)
Woodland structure: dead wood	m ³ per hectare; number per hectare	At least 30m ³ /ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources

Woodland structure: indicators of local distinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands (Perrin and Daly, 2010), archaeological and geological features as well as red data and other rare or localised species. Reenadinna Wood (NSNW code 1291) has been classified as ancient woodland by Perrin and Daly (2010)
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008), Cross and Lynn (2013) and NPWS internal files. See also Perrin et al. (2011)
Vegetation composition: typical species	Occurrence	A variety of typical native species present, including yew (<i>Taxus baccata</i>) and ash (<i>Fraxinus excelsior</i>)	Species reported in Perrin et al. (2008), Cross and Lynn (2013) and NPWS internal files. See also Perrin et al. (2011)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	The most common invasive species in this woodland type is beech (<i>Fagus sylvatica</i>), although there is evidence to suggest that it actually facilitates regeneration of yew (<i>Taxus baccata</i>). At Reenadinna, rhododendron (<i>Rhododendron ponticum</i>) is scarce; it has been removed from areas of infestation in past years (Perrin et al., 2008). Cotoneaster (<i>Cotoneaster</i> spp.) and wild clematis (<i>Clematis vitalba</i>) occur throughout Reenadinna Wood (Cross and Lynn, 2013)

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

1024 Kerry Slug *Geomalacus maculosus*

To maintain the favourable conservation condition of Kerry Slug in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: occupied 1km grid squares	Number	Number of occupied 1km grid squares at least stable, subject to natural processes. See map 7	The recorded distribution of Kerry slug (<i>Geomalacus maculosus</i>) is extensive within Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC. There have been records from 37 1km grid squares which overlap with the SAC. Most of these come from the area around Killarney National Park, and around Caragh Lake and Glencar. The Kerry slug is primarily associated with old red sandstone geology and, as this rock type underlies most of the SAC, it should be expected to occur more widely, but this has not been confirmed by positive records. See Mc Donnell and Gormally (2011) and Mc Donnell et al. (2013) for further details
Habitat extent: area of heath/bog with sandstone outcrops	Hectares	Stable or increasing, subject to natural processes	Within the SAC, Kerry slug (<i>Geomalacus maculosus</i>) occupies woodland and also wet heath/blanket bog. In the open heath/bog habitat, the species is found on the outcropping boulders of old red sandstone where the slug finds its preferred species of lichens and mosses. It is thought to retreat during dry periods to refuges around the interface between rock and soil, and crevices and holes in trees. Movement presumably does occur between rocks, but the conditions needed to facilitate this are not known
Habitat extent: woodland area	Hectares	Stable or increasing, subject to natural processes	Kerry slug (<i>Geomalacus maculosus</i>) is found in areas of woodland supporting its preferred foodplants which are species of epiphytic lichens and mosses, especially <i>Platismatia glauca</i> , <i>Usnea cornuta</i> , <i>Cladonia uncialis</i> , <i>Parmotrema perlatum</i> and <i>Lepraria incana</i> (Reich et al., 2012). The preferred trees are those with rough bark, such as oak (<i>Quercus petraea</i>), but also conifers (Reich et al., 2012)
Habitat quality: woodland	Proportion of oak trees	Proportion of sessile oak (<i>Quercus petraea</i>) in canopy at least stable	Oak is the preferred tree for this species within native broadleaved woodland. See also the conservation objective for Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles (91A0) in this volume
Habitat quality: non-native invasive species	Occurrence	Rhododendron (<i>Rhododendron ponticum</i>) in woodland and wet heath/blanket bog absent or under control	Kerry slug (<i>Geomalacus maculosus</i>) is negatively impacted by the presence of rhododendron (<i>Rhododendron ponticum</i>), which creates excessive shade and reduces cover of its epiphytic foodplants (Mc Donnell and Gormally, 2011). This is primarily, but not exclusively, a problem in woodland, and rhododendron may also impact open heath and bog. See also the conservation objectives for Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles (91A0), Northern Atlantic wet heaths with <i>Erica tetralix</i> (4010) and Blanket bogs (* if active bog) (7130) in this volume

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

1029 Freshwater Pearl Mussel *Margaritifera margaritifera*

To restore the favourable conservation condition of Freshwater Pearl Mussel in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Kilometres	See targets below and map 8. Note that the distribution target lengths include the perimeters of lakes in each catchment	The conservation objective applies to the Caragh, Currane and Gearhameen freshwater pearl mussel populations, which are listed on the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (Statutory Instrument No. 296 of 2009). The target is for the species to be sufficiently widespread to maintain itself on a long-term basis as a viable component of the Caragh, Currane and Gearhameen systems (see further information below). The Caragh and Currane are amongst eight Irish populations prioritised for conservation action (Moorkens, 2010). Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC covers most of the Caragh, Currane and Gearhameen catchments. The SAC also covers upper parts of the Kerry Blackwater population and catchment (Blackwater River (Kerry) SAC (002173)), which is also selected for freshwater pearl mussel
Distribution: Caragh	Kilometres	Maintain Caragh distribution at 35.06km	The widespread distribution of the freshwater pearl mussel in the Caragh catchment was mapped by Ross (1999). The distribution was re-examined as part of baseline monitoring in 2004 (Ross, 2004). The distribution extends through the Owenroe, Caragh, Glashawee, Caraghbeg and Meelagh Rivers, and Loughs Cloon and Acoose. The target is for the species to be sufficiently widespread to maintain itself on a long-term basis as a viable component of the Caragh system. See NPWS (2010) for further information
Distribution: Currane	Kilometres	Maintain Currane distribution at 14.90km	The known distribution of the freshwater pearl mussel extends through the Cumberagh, Cappal and Isknagahiny Lough Rivers of the Currane catchment. This may be an underestimate, however, as the system has not been fully surveyed. The target is for the species to be sufficiently widespread to maintain itself on a long-term basis as a viable component of the Currane system. See NPWS (2010) for further information
Distribution: Gearhameen	Kilometres	Maintain Gearhameen distribution at 4.45km	The known distribution of the freshwater pearl mussel is from the base of a section of falls in the Owenreagh River at Looscaunagh to the Bridge on the Gearhameen River at Lord Brandon's Cottage (Ross, 2007). Ross (2016) found small numbers of mussels in 800m surveyed downstream of the Bridge. The species may also extend further upstream in the Owenreagh and a 1994 record for Knocksallagh bog requires further investigation. The target is for the species to be sufficiently widespread to maintain itself on a long-term basis as a viable component of the Gearhameen system. See NPWS (2010) for further information

Population size	Number of adult mussels	Restore populations to at least: 2.8 million adult mussels in the Caragh, 100,000 in the Currane and 100,000 in the Gearhameen	The estimated Caragh population was 2,805,071 (Ross, 1999). Mussel density was variable and maximum abundance was 268/m ² (Ross, 1999). E. Ross found a large population in the Cumberagh River, Currane with mussels abundant (>1,500/100m) in parts (Ross, 2008, 2009, 2017). NPWS (2010) estimated the Currane population as c.100,000. NPWS staff counted over 20,000 adult mussels in an 800m stretch of the Owenreagh, Gearhameen in 2005. Ross (2007) recorded a very large population in the Owenreagh, with high mussel density in places (up to 272/m ²). Ross (2017) estimated the Owenreagh population is well in excess of 100,000 mussels. NPWS (2013) assumed the Caragh and Currane populations had declined at a rate of 1%/year and the Owenreagh at 3%/year. The improved 2014 estimate for the Caragh was 2.1 million. The target is for the species to be sufficiently abundant to maintain itself on a long-term basis as a viable component of the Caragh, Currane and Gearhameen systems
Population structure: recruitment	Percentage per size class	Restore to at least 20% of each population no more than 65mm in length; and at least 5% of each population no more than 30mm in length	Mussels of no more than 65mm are considered 'young mussels' and are found buried in the substratum and/or beneath adult mussels. Mussels of no more than 30mm are 'juvenile mussels' and are always buried in the substratum. See the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. The Sub-basin Management Plans (NPWS, 2010) summarise demographic work up to 2010. The Caragh failed both targets in 2011, 2014 and 2016 (Ross, 2011; Moorkens, 2015, 2016). The Currane failed both in 2014 (Ross, 2017). The Gearhameen failed the targets in 2015 (Ross, 2017). The Caragh, Currane and Gearhameen populations are unsustainable owing to lack of survival of juvenile mussels. NPWS (2010) predicted that, based on current rates of decline, all three populations would be extinct by 2100. The target is for sufficient juvenile recruitment to allow the species to maintain itself on a long-term basis as a viable component of the Caragh, Currane and Gearhameen systems
Population structure: adult mortality	Percentage	No more than 5% decline from previous number of live adults counted; dead shells less than 1% of the adult population and scattered in distribution	5% is considered the cut-off between the combined errors associated with natural fluctuations and sampling methods and evidence of true population decline. 1% of dead shells is considered to be indicative of natural losses. The Caragh failed the live adult target in 2011, with declines of 100% and 74% at 2 transects (Ross, 2011). The average decline 2004-2014 was 24% of live adults across 6 transects (Moorkens, 2015). The Currane failed the dead shells target in 2014, with 18%, 3% and 5% dead shells in 3 transects (Ross, 2017). The Gearhameen passed both targets in 2009 and 2015 (Ross, 2009, 2017; NPWS, 2010). The target is for sufficient survival of adults to allow the species to maintain itself on a long-term basis as a viable component of the Caragh, Currane and Gearhameen systems

Suitable habitat: extent	Kilometres	See targets below and map 8. Note that the suitable habitat target lengths include the perimeters of lakes in each catchment	The habitat is a combination of the area of 1) habitat adult and juvenile mussels can occupy; 2) spawning and nursery habitats host fish can occupy. Fish nursery and mussel habitat typically overlap. Fish spawning habitat is generally adjacent to mussel habitat, but may lie upstream of the generalised mussel distribution. Only spawning areas that regularly contribute juvenile fish to adult mussel habitat should be considered. Availability of mussel and fish habitat is determined by flow and substratum conditions. It is highly sensitive to hydromorphological changes, sedimentation and nutrient enrichment. Pressures throughout the catchment add to such impacts. Habitat in the Caragh, Currane and Gearhameen is unsuitable for juvenile recruitment (Moorkens, 2015, 2016; Ross, 2011, 2017). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Caragh, Currane and Gearhameen systems. See below
Suitable habitat: extent - Caragh	Kilometres	Restore suitable habitat in more than 33.18km in the Caragh and any additional stretches necessary for salmonid spawning	The extent of the mussel habitat in the Caragh system is well-documented; it was first mapped in 1999 (Ross, 1999) and full baseline monitoring took place in 2004 (Ross, 2004). Most of the available habitat in the Caragh system is occupied by adult mussels; however, it is unsuitable for juvenile recruitment (NPWS, 2010; Ross, 2011; Moorkens, 2015, 2016). There is evidence for localised loss of habitat as a result of land drainage and bank erosion (Ross, 2011; Moorkens, 2015). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Caragh system
Suitable habitat: extent - Currane	Kilometres	Restore suitable habitat in more than 6.86km in the Currane and any additional stretches necessary for salmonid spawning	Further survey is required to accurately map the extent of mussel habitat in the Currane system. The habitat polyline is likely to underestimate habitat extent, particularly in the Cumberagh River. Suitable habitat appears to be widespread in the Cumberagh River from Lough Derriana to Lough Currane, but the river hasn't been comprehensively surveyed (Ross, 2008, 2009, 2017; NPWS, 2010). Ross (2008) recorded suitable habitat throughout the Cappal River, but found only four mussels. There has been no dedicated survey of the Isknagahiny Lough Stream, other tributaries or lakes. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Currane system
Suitable habitat: extent - Gearhameen	Kilometres	Restore suitable habitat in more than 4.45km in the Gearhameen and any additional stretches necessary for salmonid spawning	Further survey is required to accurately map the extent of mussel habitat in the Gearhameen system. The habitat polyline is likely to underestimate habitat extent in the Owenreagh River, and more survey is required upstream of the falls at Looscaunagh. The Gearhameen River appears to have limited mussel habitat, being dominated by torrential flow and unstable, mobile cobble and gravel substrate; however, further investigation is recommended (Ross, 2009, 2017; NPWS, 2010). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Gearhameen system

Water quality: macroinvertebrate and phytobenthos (diatoms)	Ecological quality ratio (EQR)	Restore water quality - macroinvertebrates: EQR greater than 0.90 (Q4-5 or Q5); phytobenthos: EQR greater than 0.93	The EQR targets correspond to high ecological status for these two Water Framework Directive biological quality elements. They represent high water quality with very low nutrient concentrations (oligotrophic conditions). In 2009, the habitat in the Caragh, Currane and Gearhameen systems failed the macroinvertebrate target (Conservation Services, 2009; Williams, 2009; NPWS, 2010). The Currane and Gearhameen also failed the phytobenthos target (NPWS, 2010). See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Caragh, Currane and Gearhameen systems
Substratum quality: filamentous algae (macroalgae); macrophytes (rooted higher plants)	Percentage	Restore substratum quality - filamentous algae: absent or trace (less than 5%); macrophytes: absent or trace (less than 5%)	The Caragh failed the targets in 2009, 2011, 2014 and 2016 (Ross, 2009, 2011; Moorkens, 2015, 2016). Extensive algae have been recorded since monitoring began; macrophytes appear to have increased over time (Ross, 2004, 2006, 2009, 2011). The Currane failed the targets in 2009 and 2014 (NPWS, 2010; Ross, 2017). Significant crowfoot abundance has been recorded, but algal abundance tends to be relatively low (Ross, 2009, 2017). The Gearhameen failed the algal target in 2009; excessive algae have been recorded since 1996 (NPWS, 2010) and the Gearhameen failed both targets in 2015 (Ross, 2017). Excessive fungal/bacterial production is also a concern in the Caragh and Gearhameen. Sufficient recruitment of juvenile mussels is being prevented by the poor condition of the river substratum. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Caragh, Currane and Gearhameen systems
Substratum quality: sediment	Occurrence	Restore substratum quality - stable cobble and gravel substrate with very little fine material; no artificially elevated levels of fine sediment	The Caragh failed the target in 2009, 2011 and 2014, and sedimentation has increased throughout the system since monitoring began (Ross, 2004, 2006, 2009, 2011; Moorkens, 2015). The Currane failed the target in 2009 and 2014 (NPWS, 2010; Ross, 2009, 2017). The abundance of crowfoot suggests sedimentation has been a feature of the Currane for some time. The Gearhameen passed the target in 2009 and sedimentation appeared to be localised (NPWS, 2010). It failed in 2014/15, with some silt plumes (Ross, 2017). Sufficient recruitment of juvenile mussels is being prevented by the poor condition of the river substratum. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Caragh, Currane and Gearhameen systems
Substratum quality: oxygen availability	Redox potential	Restore to no more than 20% decline from water column to 5cm depth in substrate	Differences in redox potential between the water column and the substrate correlate with differences in oxygen levels. Juvenile mussels require full oxygenation while buried in gravel. In suitable habitat, there should be very little loss of redox potential between the water column and underlying gravels. The Caragh failed the redox target in 2009, with an average decline of 23.8% (NPWS, 2010). It failed with an overall decline of 22% in 2014 (Moorkens, 2015). The Currane failed with 24% in 2015 (Ross, 2017). The Owenreagh failed with 23% in 2015 (Ross, 2017). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Caragh, Currane and Gearhameen systems

Hydrological regime: flow variability	Metres per second	Restore appropriate hydrological regime	The availability of suitable freshwater pearl mussel habitat is largely determined by flow (catchment geology being the other important factor). In order to restore the habitat for the species, flow variability over the annual cycle must be such that: 1) high flows can wash fine sediments from the substratum; 2) high flows are not artificially increased so as to cause excessive scour of mussel habitat; 3) low flows do not exacerbate the deposition of fine sediment or growth of algae/macrophytes and 4) low flows do not cause stress to mussels in terms of exposure, water temperatures, food availability or aspects of the reproductive cycle; see Moorkens and Killeen (2014). Groundwater inflow to the substratum also contributes to water-cycling and favourable habitat condition. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Caragh, Currane and Gearhameen systems
Host fish	Number	Maintain sufficient juvenile salmonids to host glochidial larvae	Salmonid fish are host to the larval stage of the freshwater pearl mussel and essential to completion of the life cycle. 0+ and 1+ fish are typically used, both because of habitat overlaps and the development of immunity with age in fish. Fish presence is sufficient, as higher fish density and biomass is indicative of enriched conditions in mussel rivers. Geist et al. (2006) found that higher densities of host fish coincided with eutrophication, poor substrate quality for mussels and a lack of mussel recruitment, while significantly lower host fish density and biomass were associated with high juvenile mussel numbers. Fish movements must be such that 0+ fish remain in the mussel habitat until their 1+ summer. No fish stocking should occur within the mussel habitat, nor any works that may change the salmonid balance or residency time. In 2009, glochidia were found on salmon, but not trout, in the Caragh and Currane, but on neither salmonid in the Gearhameen (Johnston, 2009; NPWS, 2010)
Fringing habitat: area and condition	Hectares	Maintain the area and condition of fringing habitats necessary to support the population	Riparian habitats, including those along lake fringes, particularly natural/semi-natural woodlands and wetlands, even where they do not form part of a natural floodplain, are an integral part of the structure and functioning of river systems. Fringing habitats aid in the settlement of fine suspended material, protect banks from erosion, contribute to nutrient cycling and to the aquatic food web (e.g. allochthonous matter such as leaf fall) and provide habitat for certain life-stages of fish, birds and aquatic invertebrates. Shade may also be important in suppressing algal and macrophyte growth in enriched rivers and moderating temperatures. Equally, fringing habitats are dependent on rivers/lakes, particularly their water levels, and support wetland communities and species of conservation concern. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Caragh, Currane and Gearhameen systems

Conservation Objectives for : Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC [000365]

1065 Marsh Fritillary *Euphydryas aurinia*

To restore the favourable conservation condition of Marsh Fritillary in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: occupied 1km grid squares	Number	No decline, subject to natural processes	Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC has not been comprehensively surveyed for marsh fritillary (<i>Euphydryas aurinia</i>) and so the current distribution of the species in the SAC is unknown. One colony was recorded in grid square V9586 in 2006. See map 9
Proof of breeding: larval webs	Number at a representative number of sub-sites	Proof of breeding, confirmed by detection of webs	There are currently no survey data for sub-sites within the SAC
Potential habitat: area	Hectares	Area of potential habitat stable or increasing, subject to natural processes	Potential suitable habitat for marsh fritillary (<i>Euphydryas aurinia</i>) is defined as areas of vegetation where devil's-bit scabious (<i>Succisa pratensis</i>) is present, with mean height less than 50cm and with less than 10% cover of scrub more than 1m tall. There is no figure available for the total area of suitable habitat in the SAC. A survey in 2014 mapped potential habitat covering 5.4ha (Barron and Daly, 2015). This should be considered a minimum target for the SAC

Conservation Objectives for : Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC [000365]

1095 Sea Lamprey *Petromyzon marinus*

To maintain the favourable conservation condition of Sea Lamprey in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	Percentage of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	Artificial barriers can block or cause difficulties to lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. No barriers to passage have been found in float-over surveys in the Laune catchment (rivers Laune, Flesk and Gearhameen) (Inland Fisheries Ireland, 2011), and adult spawning occurs at the top of the catchment (NPWS, pers. comm.; IFI unpublished data, 2017)
Population structure of juveniles	Number of age/size groups	At least three age/size groups present	Attribute and target based on data from Harvey and Cowx (2003) and O'Connor (2007)
Juvenile density in fine sediment	Juveniles/m ²	Juvenile density at least 1/m ²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003)
Extent and distribution of spawning habitat	m ² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels
Availability of juvenile habitat	Number of positive sites in 3rd order channels (and greater), downstream of spawning areas	More than 10% of sample sites positive	The target is based on experience of catchment-wide sampling within IFI in the period 2009-2016 and is in line with proposed targets in JNCC (2015)

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

1096 Brook Lamprey *Lampetra planeri*

To maintain the favourable conservation condition of Brook Lamprey in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage of river accessible	Access to all water courses down to first order streams	Artificial barriers can block or cause difficulties to brook lampreys' migration, both up- and downstream, thereby possibly limiting species to specific stretches, restricting access to spawning areas and creating genetically isolated populations (Espanhol et al., 2007)
Population structure of juveniles	Number of age/size groups	At least three age/size groups of brook/river lamprey present	Attribute and target based on data from Harvey and Cowx (2003). It is impossible to distinguish between brook lamprey (<i>Lampetra planeri</i>) and river lamprey (<i>L. fluviatilis</i>) juveniles in the field (Gardiner, 2003), hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m ²	Mean catchment juvenile density of brook/river lamprey at least 5/m ²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from (a) Harvey and Cowx (2003) who state 10/m ² in optimal conditions and more than 2/m ² on a catchment basis and (b) JNCC (2015) who propose >5/m ² for suitable habitat
Extent and distribution of spawning habitat	m ² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels (Rooney et al., 2013)
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Many sites with suitable larval attributes, i.e. fine sediment in low velocity habitat, are found not to contain larval lamprey. This may be a function of chance or probability, or may be a consequence of insufficient recruitment to fill all spatial niches. JNCC (2005) recommended 66% positive sites at catchment level. Occupancy in excess of 50% of sites would be 'reasonable' for the Irish catchments examined to date. Target based on IFI (unpublished data) and Sugiyama and Goto (2002)

Conservation Objectives for : Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC [000365]

1099 River Lamprey *Lampetra fluviatilis*

To maintain the favourable conservation condition of River Lamprey in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage of river accessible	Access to all water courses down to first order streams	Artificial barriers can block or cause difficulties to river lampreys' migration, both up- and downstream, thereby possibly limiting species to specific stretches, restricting access to spawning areas and creating genetically isolated populations (Espanhol et al., 2007)
Population structure of juveniles	Number of age/size groups	At least three age/size groups of river/brook lamprey present	Attribute and target based on data from Harvey and Cowx (2003). It is impossible to distinguish between river lamprey (<i>Lampetra fluviatilis</i>) and brook lamprey (<i>L. planeri</i>) juveniles in the field, hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m ²	Mean catchment juvenile density of river/brook lamprey at least 5/m ²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from (a) Harvey and Cowx (2003) who state 10/m ² in optimal conditions and more than 2/m ² on a catchment basis and (b) JNCC (2015) who propose >5/m ² for suitable habitat
Extent and distribution of spawning habitat	m ² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels (Rooney et al., 2013)
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Many sites with suitable larval attributes, i.e. fine sediment in low velocity habitat, are found not to contain larval lamprey. This may be a function of chance or probability, or may be a consequence of insufficient recruitment to fill all spatial niches. JNCC (2005) recommended 66% positive sites at catchment level. Occupancy in excess of 50% of sites would be 'reasonable' for the Irish catchments examined to date. Target based on IFI (unpublished data) and Sugiyama and Goto (2002)

Conservation Objectives for : Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC [000365]

1106

Salmon *Salmo salar*

To maintain the favourable conservation condition of Atlantic Salmon in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	Percentage of river accessible	100% of river channels down to second order accessible from estuary	Artificial barriers block salmon's upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. There are no artificial barriers on the Cumberagh/Finglas, Caragh, Ferta and Flesk/Laune systems; there are a number of natural waterfall barriers
Adult spawning fish	Number	Conservation limit (CL) for each system consistently exceeded	A conservation limit (CL) is defined by the North Atlantic Salmon Conservation Organisation (NASCO) as "the spawning stock level that produces long-term average maximum sustainable yield as derived from the adult to adult stock and recruitment relationship". The target is based on the Standing Scientific Committee on Salmon (SSCS) annual model output of CL attainment levels. See SSCS (2016). Attainment of CL estimates are derived from direct counts of adults (rod catch, fish counter) or indirectly by fry abundance counts. The Ferta is currently exceeding its CL and the Cumberagh, Caragh, and Flesk/Laune are currently exceeding both the 1 sea winter and multi sea winter CL
Salmon fry abundance	Number of fry/5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 minutes sampling	The target is the threshold value for rivers currently exceeding their conservation limit (CL)
Out-migrating smolt abundance	Number	No significant decline	Smolt abundance can be negatively affected by a number of impacts such as estuarine pollution, predation and sea lice (<i>Lepeophtheirus salmonis</i>). Marine salmon farming takes place in Kenmare Bay into which the Cumberagh discharges. There are no marine salmon farms in the Caragh, Ferta and Flesk/Laune estuaries
Number and distribution of redds	Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes	Salmon spawn in clean gravels. Artificial barriers are not preventing salmon from accessing suitable spawning habitat in the Cumberagh/Finglas, Caragh, Ferta and Flesk/Laune systems
Water quality	EPA Q value	At least Q4 at all sites sampled by EPA	Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)

Conservation Objectives for : Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC [000365]

1303 Lesser Horseshoe Bat *Rhinolophus hipposideros*

To maintain the favourable conservation condition of Lesser Horseshoe Bat in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population per roost	Number	Minimum number of 182 bats in winter for Roost ID 623; minimum number of 127 in winter and 358 in summer for Roost ID 505; minimum number of 176 in winter and 315 in summer for Roost ID 296; minimum number of 218 in summer for Roost ID 615. See map 10	Figures of 100 bats for summer roosts and 50 bats for winter roosts were set as the minimum qualifying standards (MQS) when SACs were being selected for lesser horseshoe bat (<i>Rhinolophus hipposideros</i>). NPWS conduct annual counts at each qualifying roost. Qualified means from the 2010-2016 data have been calculated whereby the year with the highest maximum count and the year with the lowest maximum count over that period were removed, and the mean of the remaining years was calculated. This mean is set as the target figure for the roost except where the figure falls below the MQS, then the MQS (100 or 50 as appropriate) is used as the target. Some structures may host qualifying winter roosts AND qualifying summer roosts, in which case separate targets have been set for each season using the summer and winter count data
Winter roosts	Condition	No decline	Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC has been selected for lesser horseshoe bats because of the presence of a number of internationally important winter roosts. Damage or disturbance to a roost or to the habitat immediately surrounding a roost will lead to a decline in its condition (Mitchell-Jones et al., 2007)
Summer roosts	Condition	No decline	Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC has been selected for lesser horseshoe bats because of the presence of a number of internationally important summer roosts. Damage or disturbance to a roost or to the habitat immediately surrounding a roost will lead to a decline in its condition (Kelleher and Marnell, 2006)
Number of auxillary roosts	Number and condition	No decline	Lesser horseshoe bat populations will use a variety of roosts during the year besides the main summer maternity and winter hibernation roosts. Such additional roosts within the SAC may be important as night roosts, satellite roosts, etc. In addition, in response to weather conditions for example, bats may use different seasonal roosts from year to year; this is particularly noticeable in winter. Several other winter and summer roosts that support lesser horseshoe bats, but at numbers below the MQS figures, are known from this SAC. A database of all known lesser horseshoe roosts is available on the National Biodiversity Data Centre website. NB further unrecorded roosts may also be present within this SAC
Extent of potential foraging habitat	Hectares	No significant decline	Lesser horseshoe bats normally forage in woodlands/scrub within 2.5km of their roosts (Schofield, 2008). See map 10 which shows a 2.5km zone around the above named roosts and identifies potential foraging grounds
Linear features	Kilometres	No significant loss, within 2.5km of qualifying roosts. See map 10	This species follows commuting routes from its roost to its foraging grounds. Lesser horseshoe bats will not cross open ground. Consequently, linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species, most importantly within 2.5km around each roost (Schofield, 2008)

Light pollution	Lux	No significant increase in artificial light intensity adjacent to named roosts or along commuting routes within 2.5km of those roosts. See map 10	Lesser horseshoes are very sensitive to light pollution and will avoid brightly lit areas. Inappropriate lighting around roosts may cause abandonment; lighting along commuting routes may cause preferred foraging areas to be abandoned, thus increasing the energetic cost for bats (Schofield, 2008)
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Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

1355 Otter *Lutra lutra*

To maintain the favourable conservation condition of Otter in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage positive survey sites	No significant decline	Measure based on standard otter survey technique. Favourable Conservation Status (FCS) target, based on 1980/81 survey findings, is 88% in SACs. Current range is estimated at 93.6% (Reid et al., 2013)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 1,936.8ha along river banks/lake shoreline/around ponds	No field survey. Areas mapped to include 10m terrestrial buffer along shorelines and river banks identified as critical for otters (NPWS, 2007)
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 1,246.2km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982)
Extent of freshwater (lake) habitat	Hectares	No significant decline. Area mapped and calculated as 2,710.3ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (NPWS, 2007)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk and Moorhouse, 1991; Kruuk, 2006)
Fish biomass available	Kilograms	No significant decline	Broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006; Reid et al., 2013)
Barriers to connectivity	Number	No significant increase. For guidance, see map 11	Otters will regularly commute across stretches of open water up to 500m e.g. between the mainland and an island; between two islands; across an estuary (De Jongh and O'Neill, 2010). It is important that such commuting routes are not obstructed

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

1421 Killarney Fern *Trichomanes speciosum*

To maintain the favourable conservation condition of Killarney Fern in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Occurrence	No loss in geographical spread of populations, subject to natural processes	As its common name indicates, the Killarney area of Co. Kerry is an important location for this species, which formerly occurred at several sites here and elsewhere to the south-west in such abundance as to form a local tourist attraction. However, it became a favourite of Victorian-era fern enthusiasts and consequently plants were removed from many sites, resulting in considerable losses. The species was not entirely eradicated, however, and persisted at many locations within the SAC, particularly in remoter areas and more inaccessible situations. Since 1960 there have been confirmed records from sites within the SAC in eight hectads: V56, V66, V67, V68, V77, V88, V97 and V98; a record from a further hectad, V58, requires confirmation. The species has not been recorded from V78 since 1844. Exact locations are not mapped here on account of the threat posed by illegal collecting. Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Number of populations	Number	No decline, subject to natural processes	20 confirmed populations of the species have been recorded in the SAC since 1960. Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Number of colonies	Number	No decline, subject to natural processes	52 colonies of the species have been identified in the 20 confirmed populations recorded in the SAC since 1960. Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Population: life-cycle stage	Type (sporophyte or gametophyte)	Maintain life-cycle stage composition of populations, subject to natural processes	31 of the 52 colonies recorded since 1960 are composed of sporophytes (frond stage), of which 12 have co-existing gametophytes (filamentous stage), and 21 are of gametophytes only. Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Population size: area of occupancy	Square metres	No decline, subject to natural processes	Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Population size: living sporophyte fronds	Number	No decline, subject to natural processes	Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Population structure: young and unfurling fronds	Occurrence	Young (not fully expanded) and/or unfurling (crozier) fronds present in populations previously observed to have these, subject to natural processes	Young and/or unfurling fronds have been recorded from populations in the SAC. Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Population structure: fertile fronds	Occurrence	Fertile fronds present in populations previously observed to have these, subject to natural processes	Fertile fronds have been recorded from populations in the SAC. Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Population structure: juvenile sporophyte fronds emerging from gametophytes	Number	No decline, subject to natural processes	Juvenile sporophyte fronds emerging from gametophytes have been recorded from populations in the SAC. Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files

Habitat extent	Hectares	No loss of suitable habitat, subject to natural processes	The species grows in deeply shaded, humid situations - dripping caves, overhangs and crevices on cliffs, rocky slopes, by waterfalls, in stream ravines and gullies, on rock or soil banks in woodlands and, occasionally, under fallen trees and on the floor of damp woodlands. Whilst also occurring in these habitats, the gametophyte (filamentous) stage can grow in drier areas that do not suit the sporophyte. Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Hydrological conditions: wet/damp microhabitats	Occurrence	Maintain hydrological conditions at the locations of known populations - visible water source, with dripping or seeping water present and/or substrate wet/damp to touch, subject to natural processes	Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Hydrological conditions: relative humidity	Percentage	Maintain relative humidity levels at known colonies at not less than 80%, subject to natural processes	Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Hydrological conditions: desiccated fronds	Number	No increase, subject to natural processes	Presence of desiccated sporophyte fronds and gametophyte mats is indicative of unsuitable conditions. Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Light levels: shading	Shade index score	At least 4 for woodland sporophyte-only and mixed colonies; at least 5 for open upland sporophyte-only and mixed colonies; at least 6 for gametophyte-only colonies, subject to natural processes	Shade Index: 4. Moderate shade, e.g. light-medium deciduous canopy with sun flecks. 5. Permanently shaded from direct sunlight but otherwise open to sky. 6. Deep woodland (e.g. coniferous or in ravine) shade, no sun flecks. 7. Perpetual deep shade, e.g. cave entrance, beneath boulder. The species occurs in the SAC in both woodland and open upland sites. Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Woodland canopy cover	Percentage	No loss of woodland canopy at, or in the vicinity of, the locations of known populations and canopy cover here maintained at more than 33%, subject to natural processes	Woodland management at or near to locations of known populations of the species must take account of its habitat requirements, in particular, with regard to maintenance of sufficient canopy cover. The species occurs in the SAC in both woodland and open upland sites. Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files
Invasive species	Occurrence	Maintain absence of invasive non-native and vigorous native plant species at the locations of known populations or, if present, maintain vegetation cover of these at less than 10%, taking into account the habitat requirements of <i>T. speciosum</i>	In order to avoid negative impacts on <i>Trichomanes speciosum</i> , its habitat requirements (site hydrology, relative humidity, canopy cover, shading levels, etc.) must be taken into account in locations that are subject to or proposed for management actions to control invasive non-native and/or vigorous native plant species. Based on Ní Dhúill et al. (2015), NPWS (2013) and NPWS internal files

Conservation Objectives for : Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC [000365]

1833 Slender Naiad *Najas flexilis*

To maintain the favourable conservation condition of Slender Naiad in Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population extent	Hectares; distribution	No change to the spatial extent of <i>Najas flexilis</i> within the lakes, subject to natural processes. See map 12 for known locations	The selection of Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC for <i>Najas flexilis</i> (slender naiad) was based on its presence in Loughs Acoose, Caragh, Leane, the Upper Lake and The Long Range. Records for <i>Najas flexilis</i> in Lough Adoolig and Muckross Lake have been rejected (Roden and Murphy, 2014). See the Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC conservation objectives supporting document for <i>Najas flexilis</i> for further details
Population depth	Metres	No change to the depth range of <i>Najas flexilis</i> within the lakes, subject to natural processes	See the <i>Najas flexilis</i> supporting document for further details
Population viability	Plant traits	No decline in plant fitness, subject to natural processes	See the <i>Najas flexilis</i> supporting document for further details
Population abundance	Square metres	No change to the cover abundance of <i>Najas flexilis</i> , subject to natural processes	See the <i>Najas flexilis</i> supporting document for further details
Species distribution	Occurrence	No decline, subject to natural processes	See the <i>Najas flexilis</i> supporting document for further details
Habitat extent	Hectares	No decline, subject to natural processes	See the <i>Najas flexilis</i> supporting document for further details
Hydrological regime: water level fluctuations	Metres	Maintain appropriate natural hydrological regime necessary to support the habitat for the species	See the <i>Najas flexilis</i> supporting document for further details
Lake substratum quality	Various	Maintain appropriate substratum type, extent and chemistry to support the populations of the species	See the <i>Najas flexilis</i> supporting document for further details
Water quality	Various	Maintain/restore appropriate water quality to support the populations of the species	See the <i>Najas flexilis</i> supporting document for further details
Acidification status	pH units; mg/l	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the populations of <i>Najas flexilis</i> , subject to natural processes	See the <i>Najas flexilis</i> supporting document for further details
Water colour	mg/l PtCo	Maintain appropriate water colour to support the populations of <i>Najas flexilis</i>	See the <i>Najas flexilis</i> supporting document for further details
Associated species	Species composition and abundance	Maintain appropriate associated species and vegetation communities to support the populations of <i>Najas flexilis</i>	See the <i>Najas flexilis</i> supporting document for further details

Fringing habitat: Hectares
area and condition

Maintain the area and
condition of fringing
habitats necessary to
support the populations of
Najas flexilis

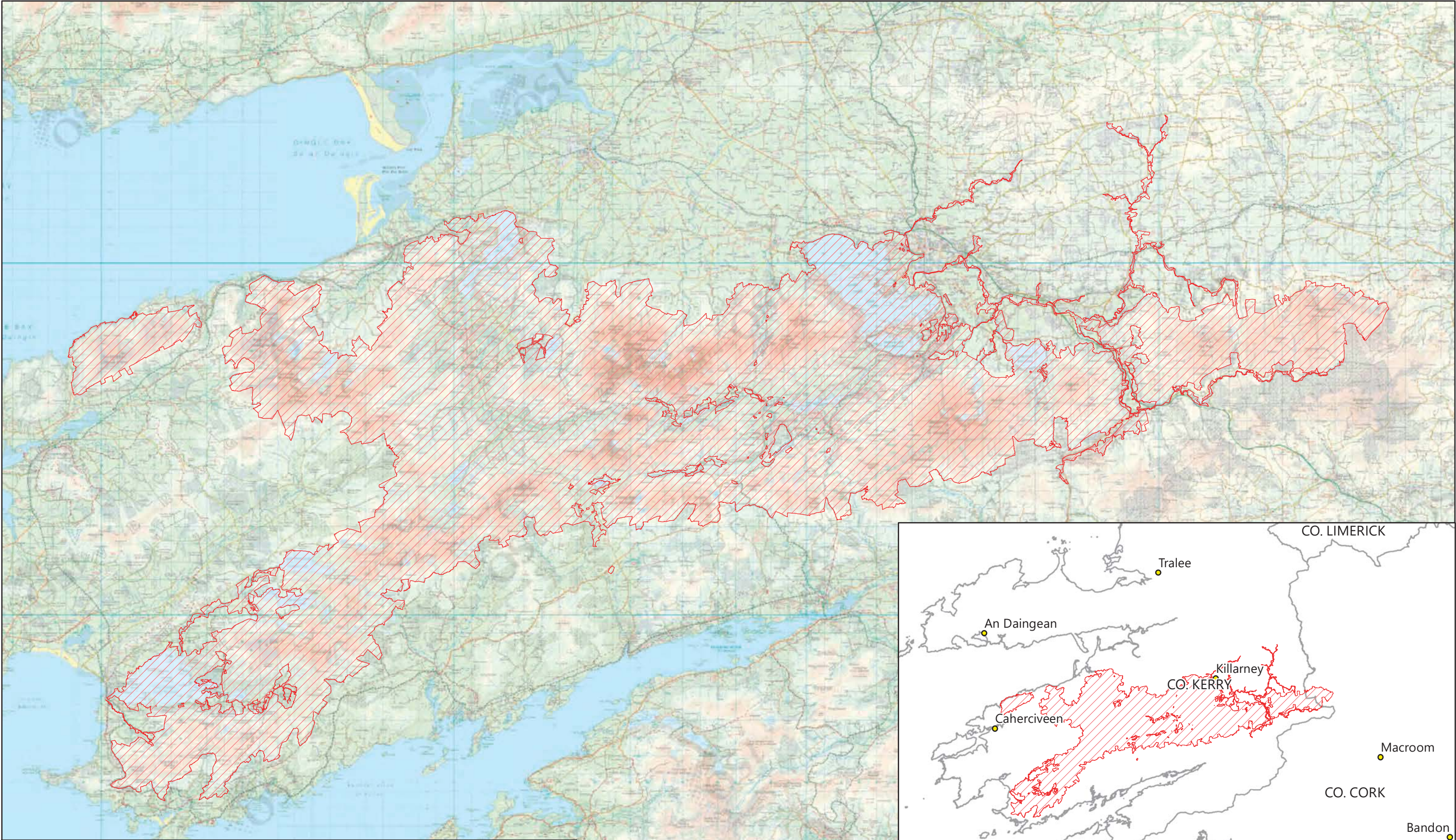
See the *Najas flexilis* supporting document for
further details

Conservation Objectives for : Killarney National Park, Macgillacuddy's Reeks and Caragh River Catchment SAC [000365]


5046 Killarney Shad *Alosa fallax killarnensis*


To restore the favourable conservation condition of Killarney shad in Killarney National Park, Macgillacuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Occurrence	Widespread recording during appropriate fish sampling operations (e.g. netting, hydroacoustics); access into inflowing and outflowing rivers for potential spawning migrations	Killarney shad (<i>Alosa fallax killarnensis</i>) is unique to Lough Leane (Coscia et al., 2013), which lies within Killarney National Park. Macgillacuddy's Reeks and Caragh River Catchment SAC. The species is listed as Vulnerable (D2) in the Irish red list (King et al., 2011), based on the species' restricted distribution and area of occupancy
Population structure: age classes	Number of age classes	Full range of age classes present	Inland Fisheries Ireland (IFI) surveys for Water Framework Directive (WFD) purposes (Kelly et al., 2012, 2015) indicate on-going occurrence of this species, as well as recruitment to adult size. Trials with pelagic netting indicated a range of age classes when sampled in May 2014, including fish spawned in May 2013 (IFI, unpublished data)
Extent and distribution of spawning habitat	m ² and occurrence	No decline in extent and distribution of spawning habitats	Anecdotal reports indicate that spawning occurs on gravelled shores of the islands at and west of Ross Bay, as well as along the eastern shoreline of Castle Bay
Water quality: oxygen levels	Milligrammes per litre	No lower than 5mg/l	Attribute and target based on Maas et al. (2008). IFI surveys of 2008, 2011 and 2014 all allocated a WFD 'good' status in the context of the fish Ecological Quality Ratio (EQR) (Kelly et al., 2015). Note that the conservation objectives for the lake habitats 3110 and 3130 require WFD 'high' status targets to be met
Spawning habitat quality: filamentous algae; macrophytes; sediment	Occurrence	Maintain stable gravel substrate with very little fine material, free of filamentous algal (macroalgae) growth and macrophyte (rooted higher plants) growth	Habitat quality not assessed. Considered satisfactory in terms of any algal accumulations, given the overall 'good' status for WFD is allocated to the lake. Considered satisfactory in terms of gravel composition and low levels of fine sediment accumulations in gravel bed areas due to the exposed nature of the site to wave action. However, note that the conservation objectives for the lake habitats 3110 and 3130 require WFD 'high' status targets to be met



Legend

 Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC 000365



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MAP 1:
**KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S
REEKS AND CARAGH RIVERS RIVER CATCHMENT SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION**

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 000365; version 3. CO. KERRY / CO. CORK.

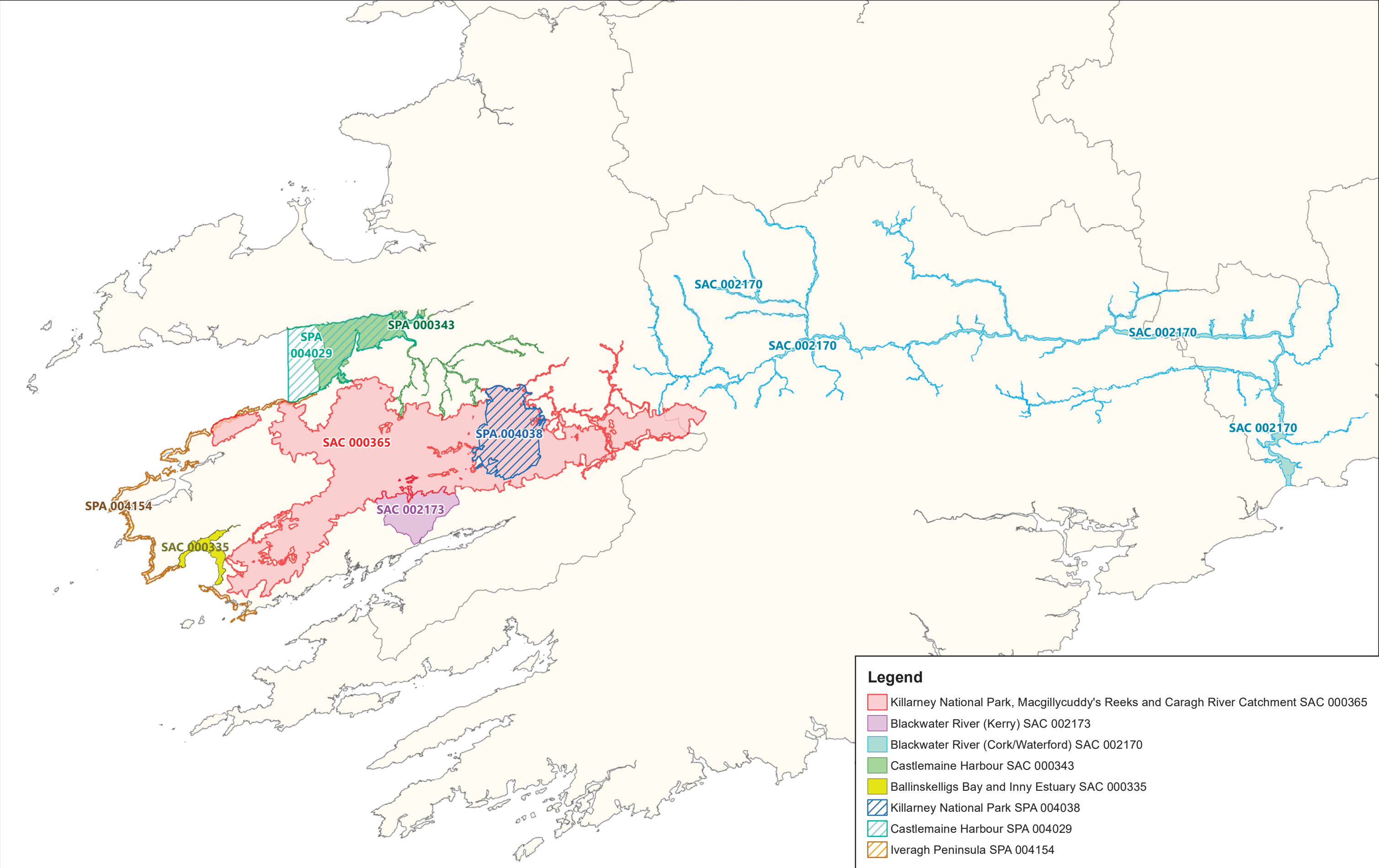
0 3 6 9 12 km

The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision.
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Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaíthe. Suirbhéarachtá Ordonáis na hÉireann Ceadúnas Uimh EN 0059216. © Suirbhéarachtá Ordonáis na hÉireann Rialtas na hÉireann

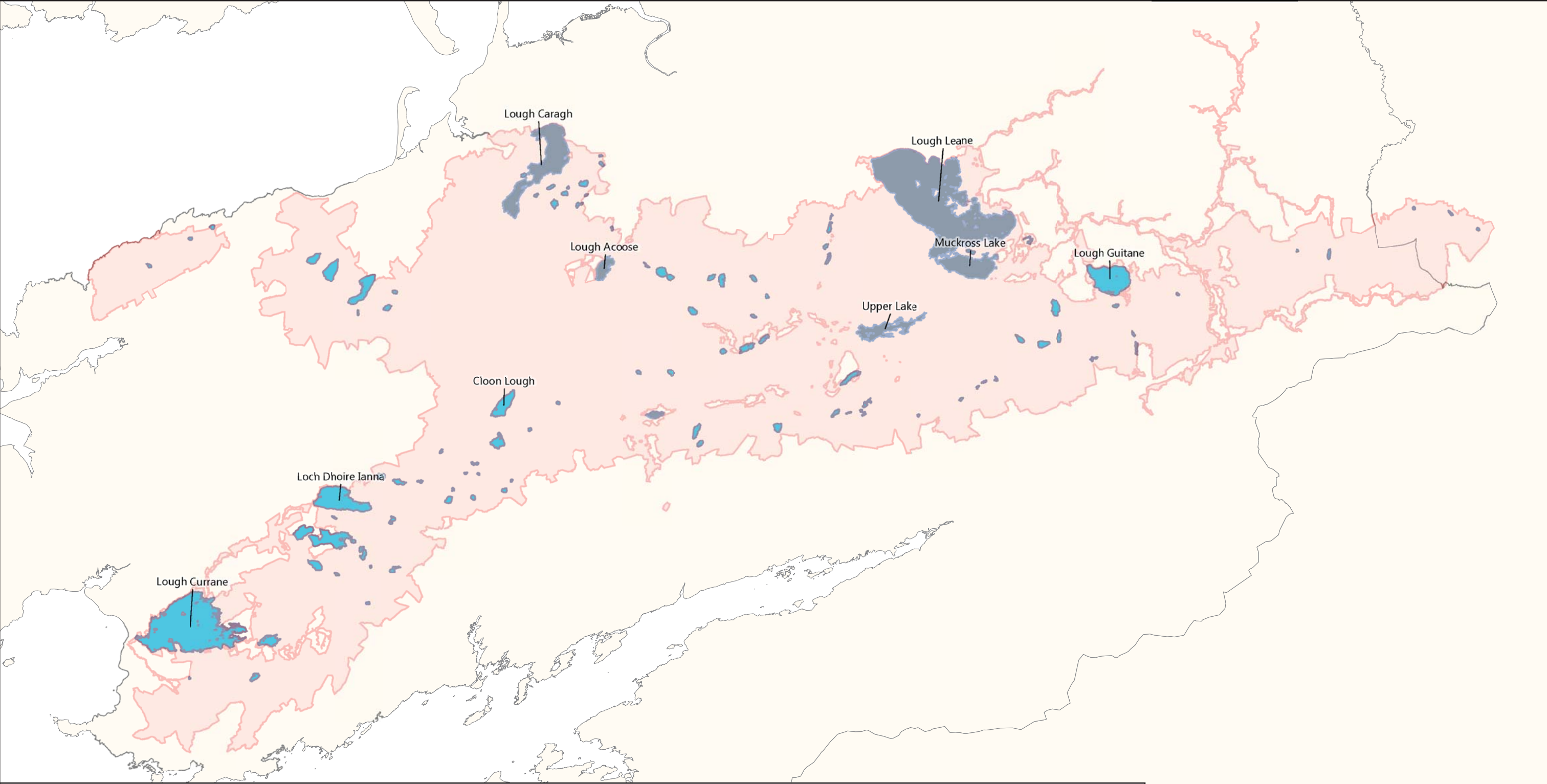


Map Version 1
Date: Aug 2017



Legend

- Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC 000365
- Blackwater River (Kerry) SAC 002173
- Blackwater River (Cork/Waterford) SAC 002170
- Castlemaine Harbour SAC 000343
- Ballinskelligs Bay and Inny Estuary SAC 000335
- Killarney National Park SPA 004038
- Castlemaine Harbour SPA 004029
- Iveragh Peninsula SPA 004154



Legend

- Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC 000365
- OSi Discovery Series County Boundary
- Indicative Lake Habitats**
- 3110 Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)
- 3110 / 3130 Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) / Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

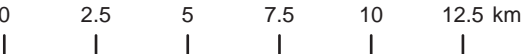


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MAP 3:
KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S
REEKS AND CARAGH REEKS RIVER CATCHMENT SAC
CONSERVATION OBJECTIVES
INDICATIVE LAKE HABITATS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 000365; version 3. CO. KERRY / CO. CORK.



The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision.
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Map Version 1
Date: Aug 2017



Legend

- ★ 6130 Calaminarian grasslands of the *Violetalia calaminariae*
- 6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils *Molinia caerulea*
- Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC 000365
- ISGS Survey Site Boundaries


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MAP 4:
KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S
REEKS AND CARAGH REEKS RIVER CATCHMENT SAC
CONSERVATION OBJECTIVES
GRASSLAND HABITATS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

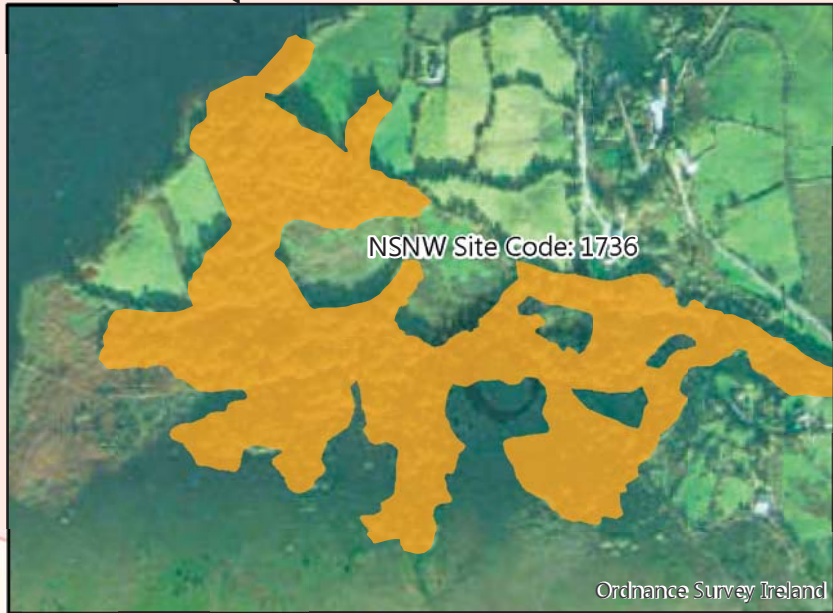
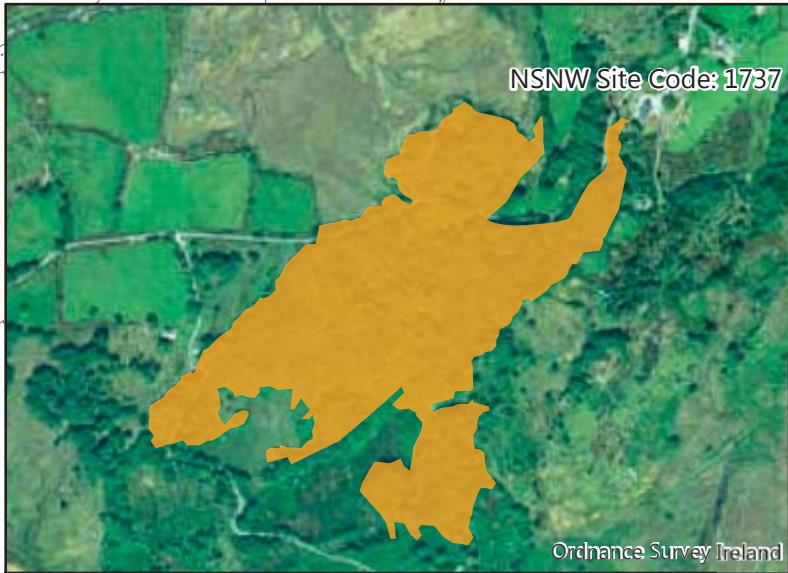
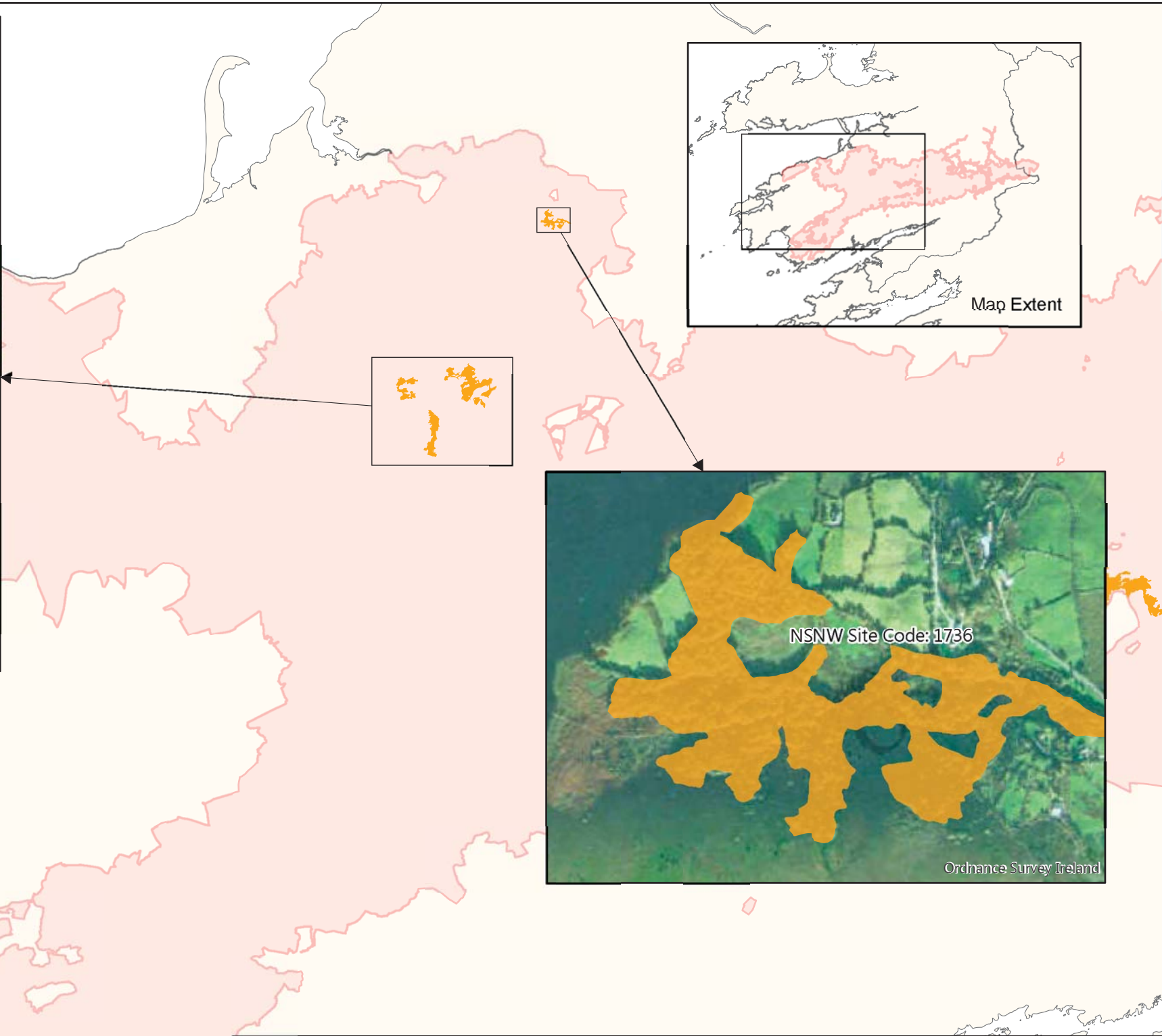
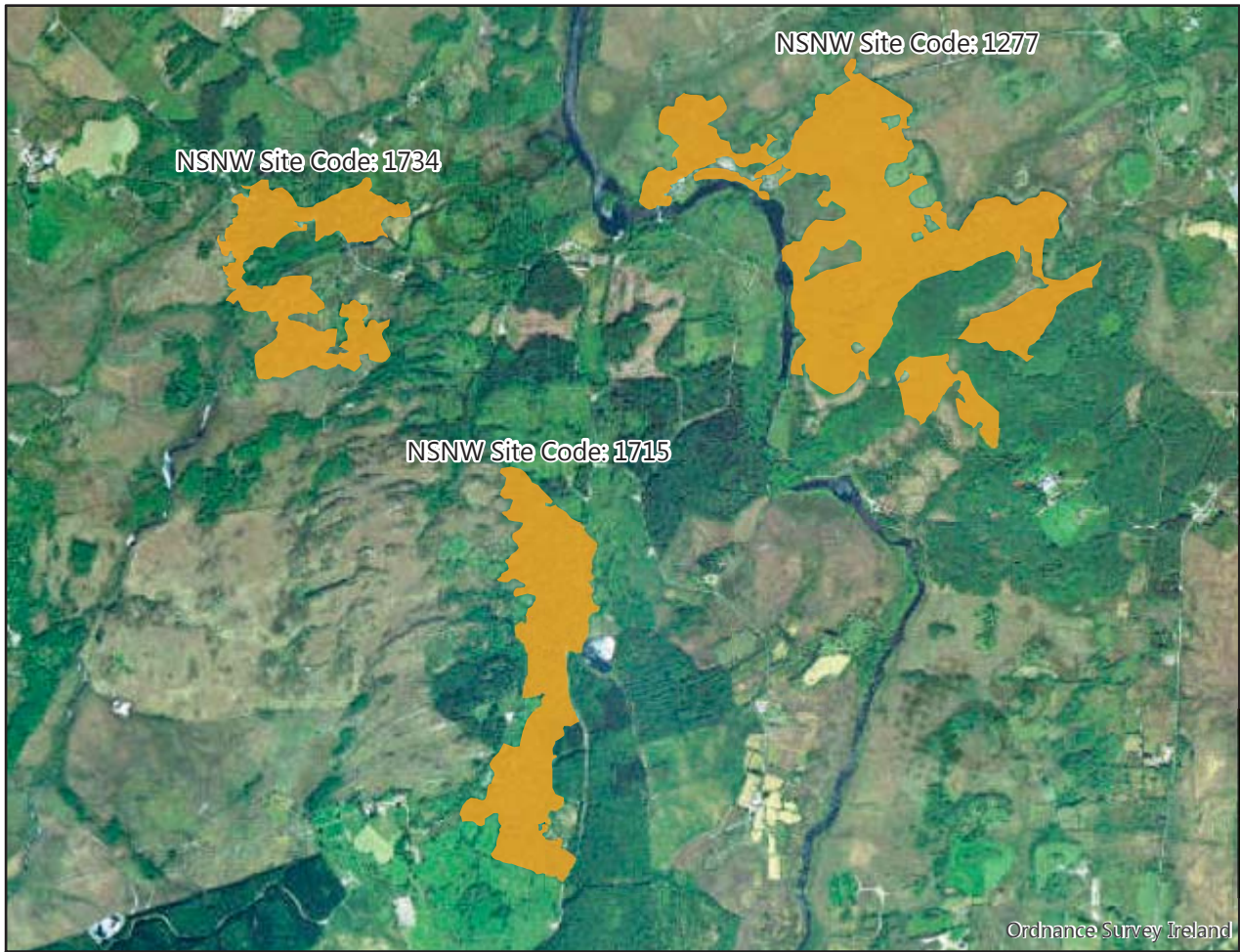
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0 0.2 0.4 0.6 0.8 1 km

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Map Version 1
Date: Aug 2017



Legend

Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC 000365

OSi Discovery Series County Boundary

Qualifying Interests

- 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
- 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)
- 91J0 *Taxus baccata* woods of the British Isles

Legend

Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC 000365

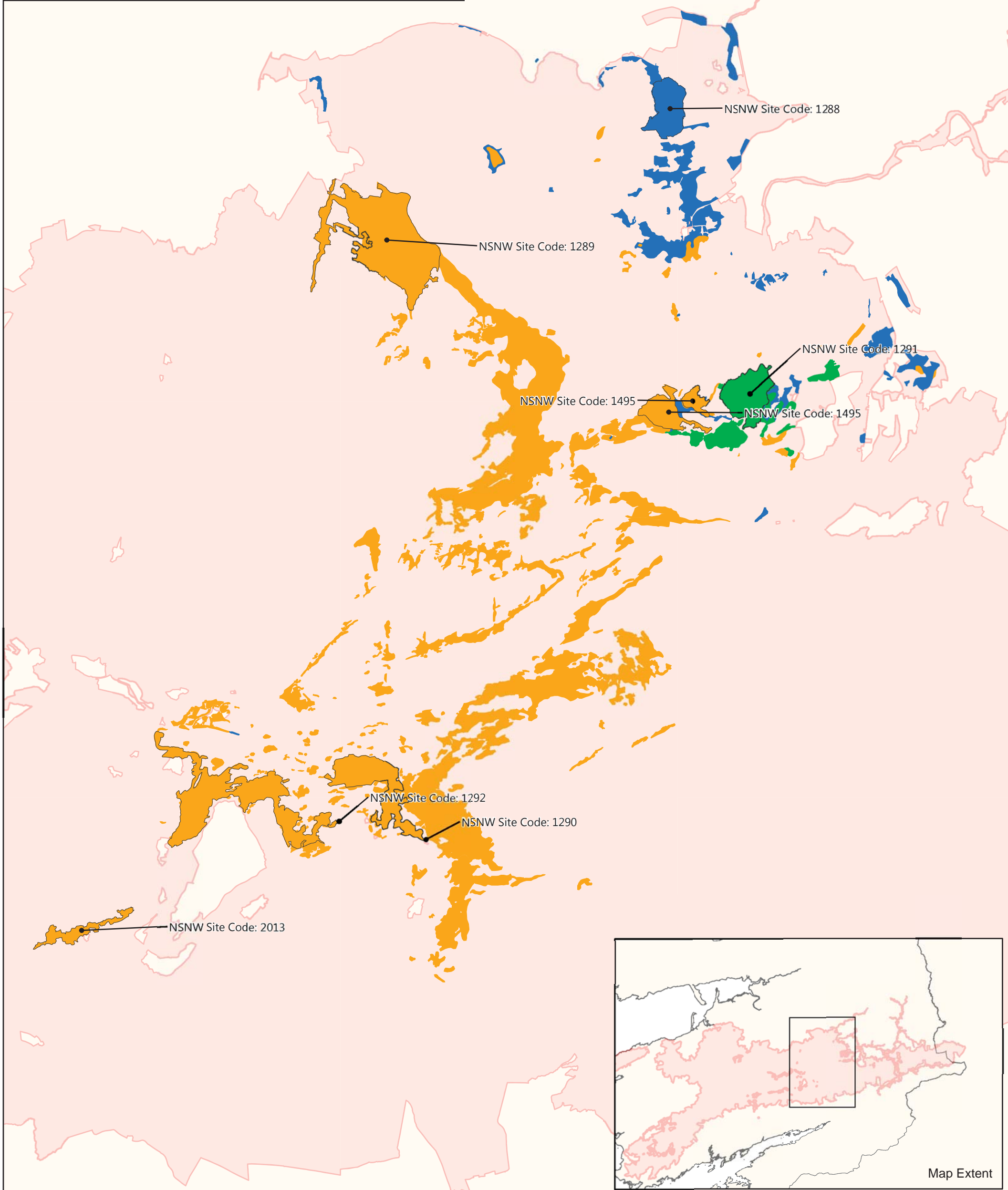
 OSi Discovery Series County Boundary

 National Survey of Native Woodlands Survey Site Boundaries

Qualifying Interests

91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)

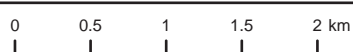
91J0 *Taxus baccata* woods of the British Isles

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**MAP 6:
KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S
REEKS AND CARAGH REEKS RIVER CATCHMENT SAC
CONSERVATION OBJECTIVES
WOODLAND HABITATS - EAST**

Map to be read in conjunction with the NPWS Conservation Objectives Document.

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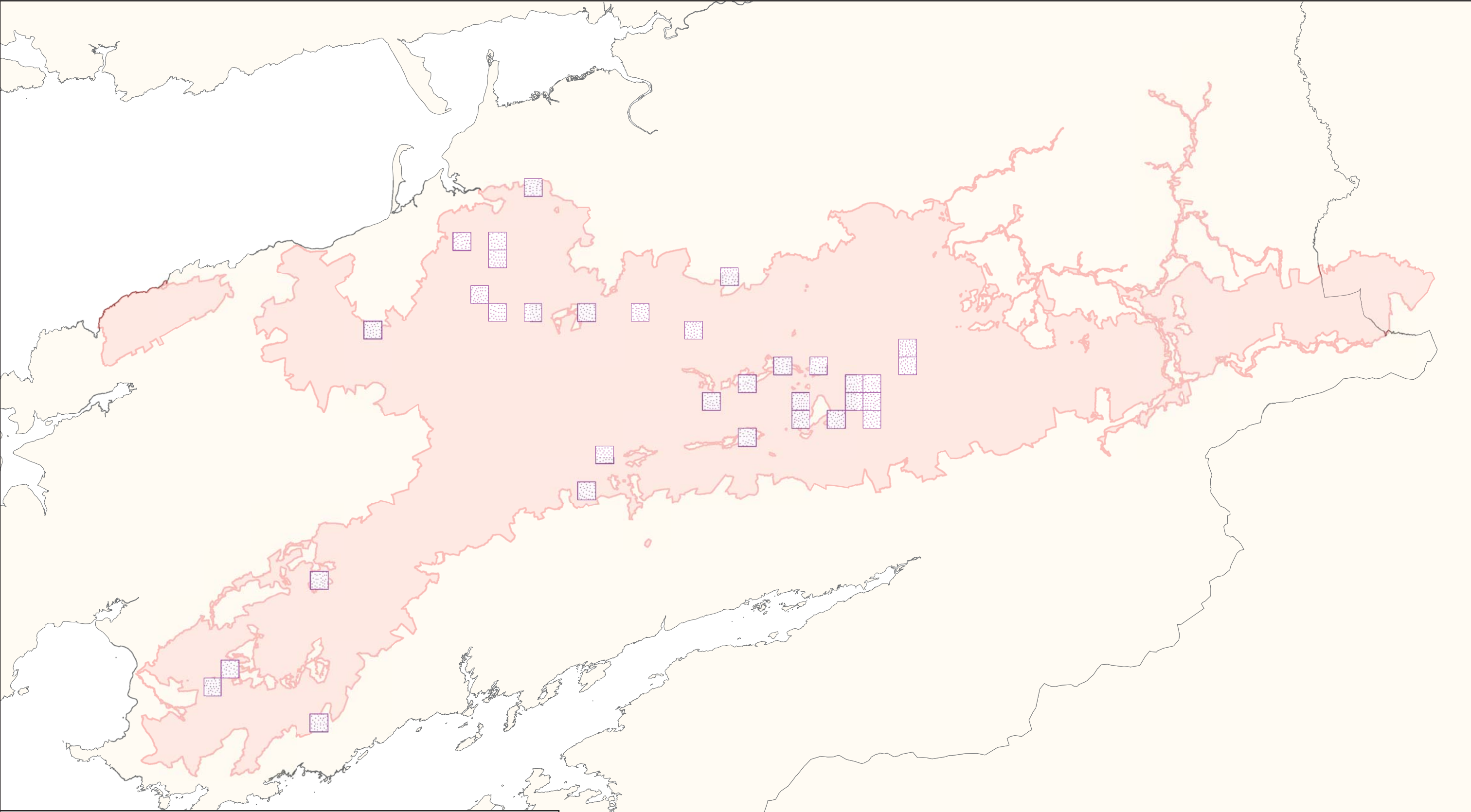


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Legend

 1024 Kerry Slug *Geomalacus maculosus* 1 km Grid Squares

 Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC 000365

 OSi Discovery Series County Boundary



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MAP 7:
**KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S
REEKS AND CARAGH REEKS RIVER CATCHMENT SAC
CONSERVATION OBJECTIVES
KERRY SLUG**

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
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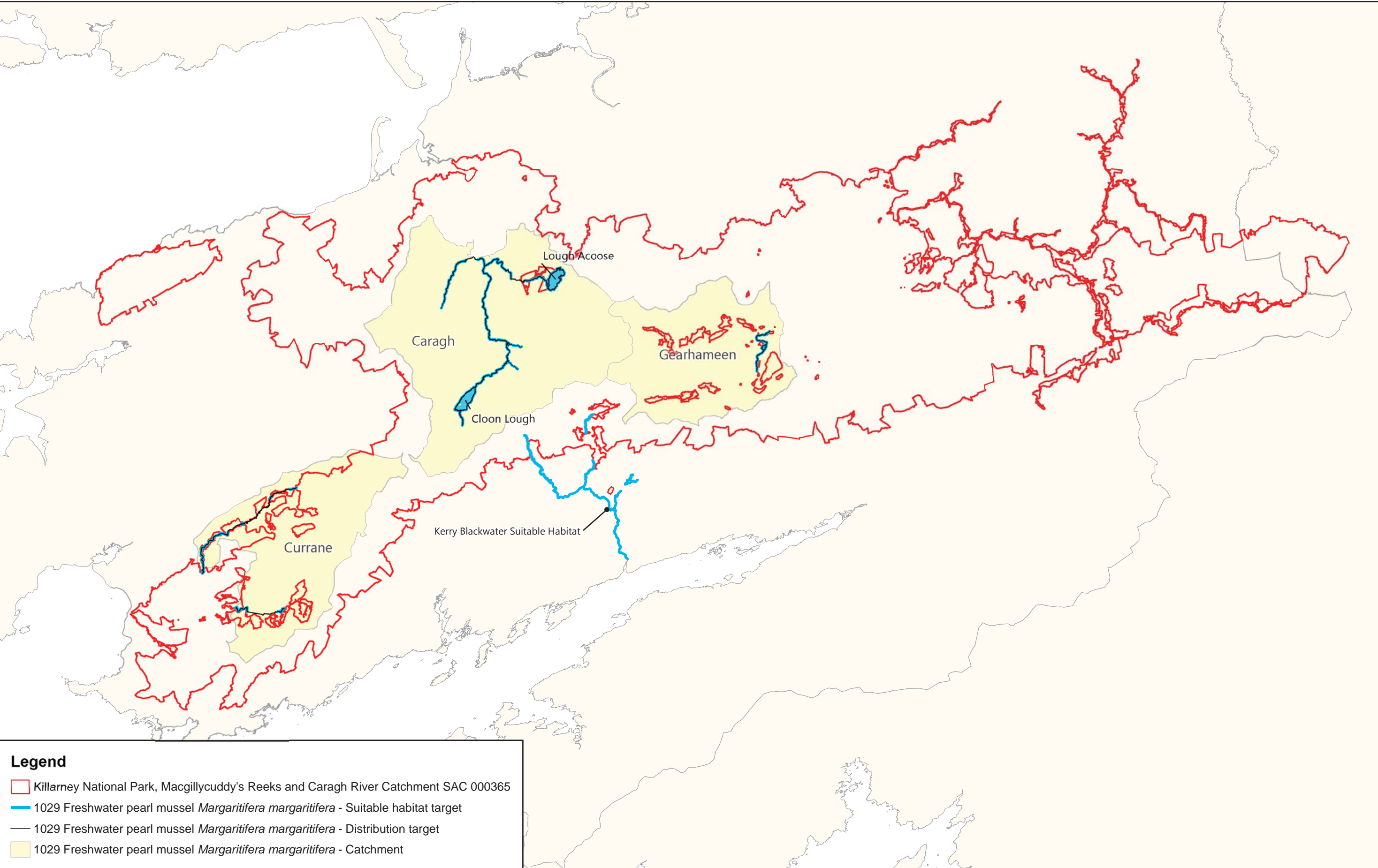
036912 km

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
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Legend

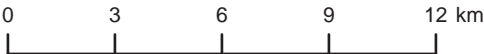
-  Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC 000365
-  1029 Freshwater pearl mussel *Margaritifera margaritifera* - Suitable habitat target
-  1029 Freshwater pearl mussel *Margaritifera margaritifera* - Distribution target
-  1029 Freshwater pearl mussel *Margaritifera margaritifera* - Catchment



MAP 8:
KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S
REEKS AND CARAGH REEKS RIVER CATCHMENT SAC
CONSERVATION OBJECTIVES
FRESHWATER PEARL MUSSEL

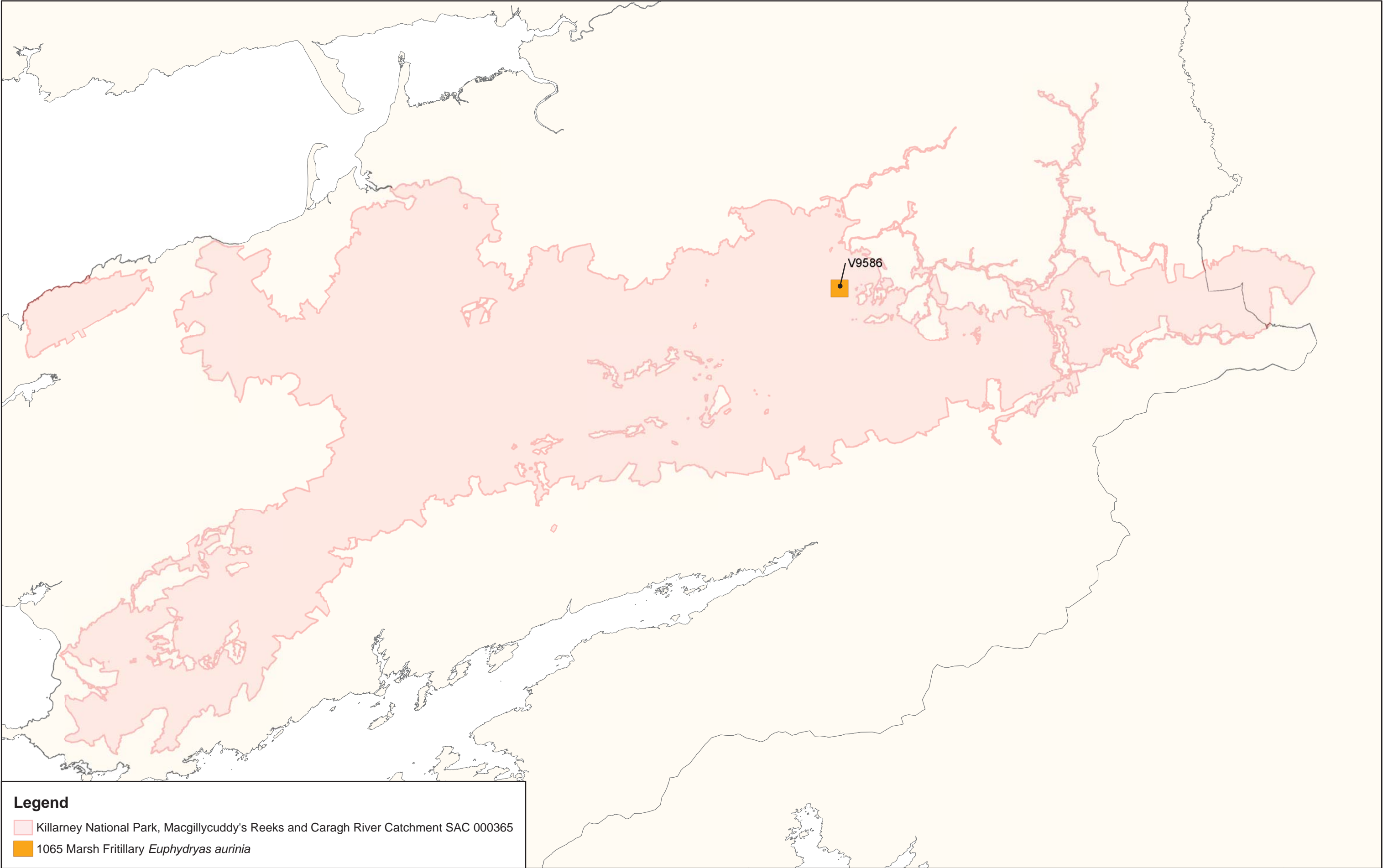
Map to be read in conjunction with the NPWS Conservation Objectives Document.

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Legend

Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC 000365

1065 Marsh Fritillary *Euphydryas aurinia*



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MAP 9:
KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S
REEKS AND CARAGH REEKS RIVER CATCHMENT SAC
CONSERVATION OBJECTIVES
MARSH FRITILLARY

Map to be read in conjunction with the NPWS Conservation Objectives Document.

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0246810

km

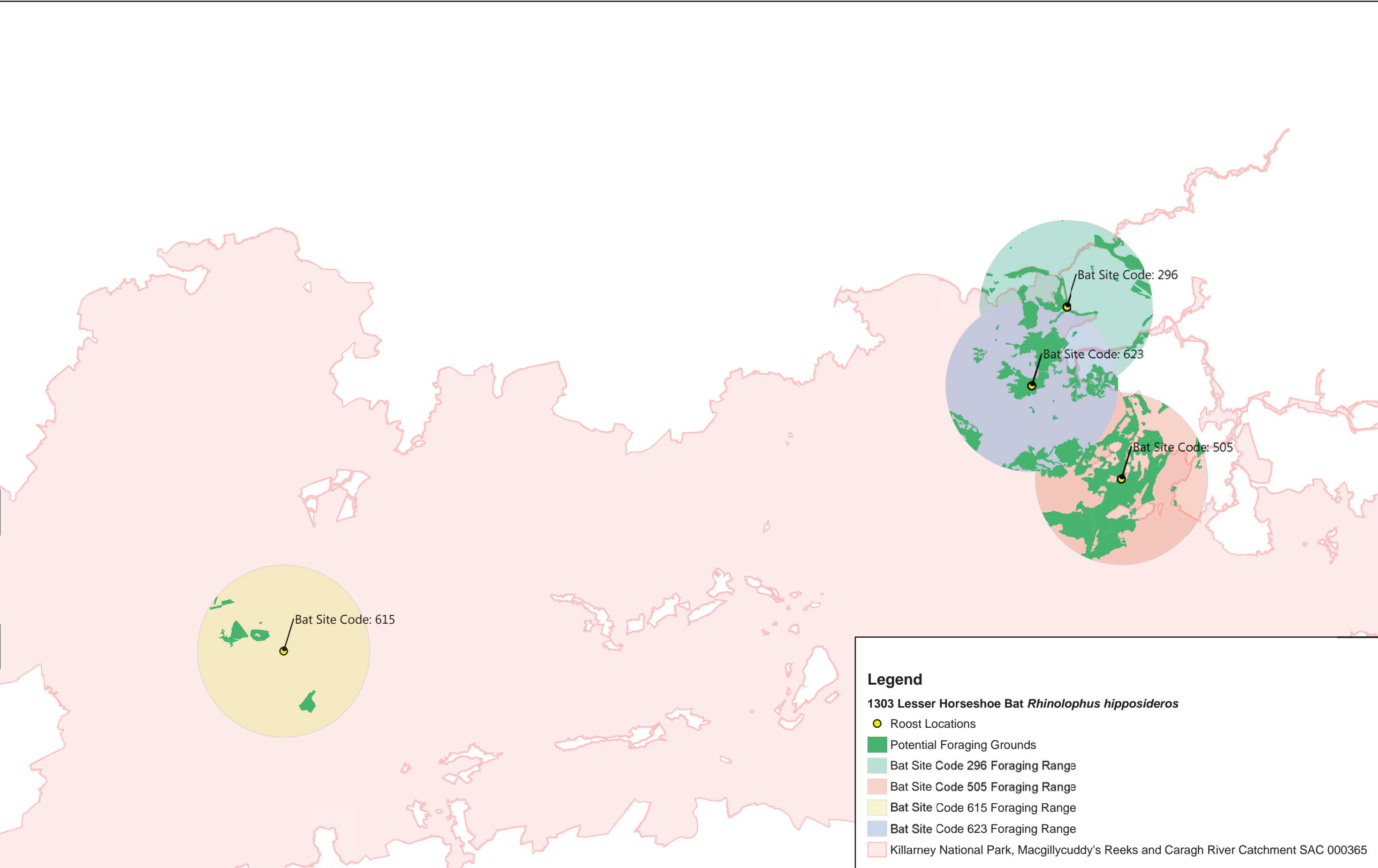
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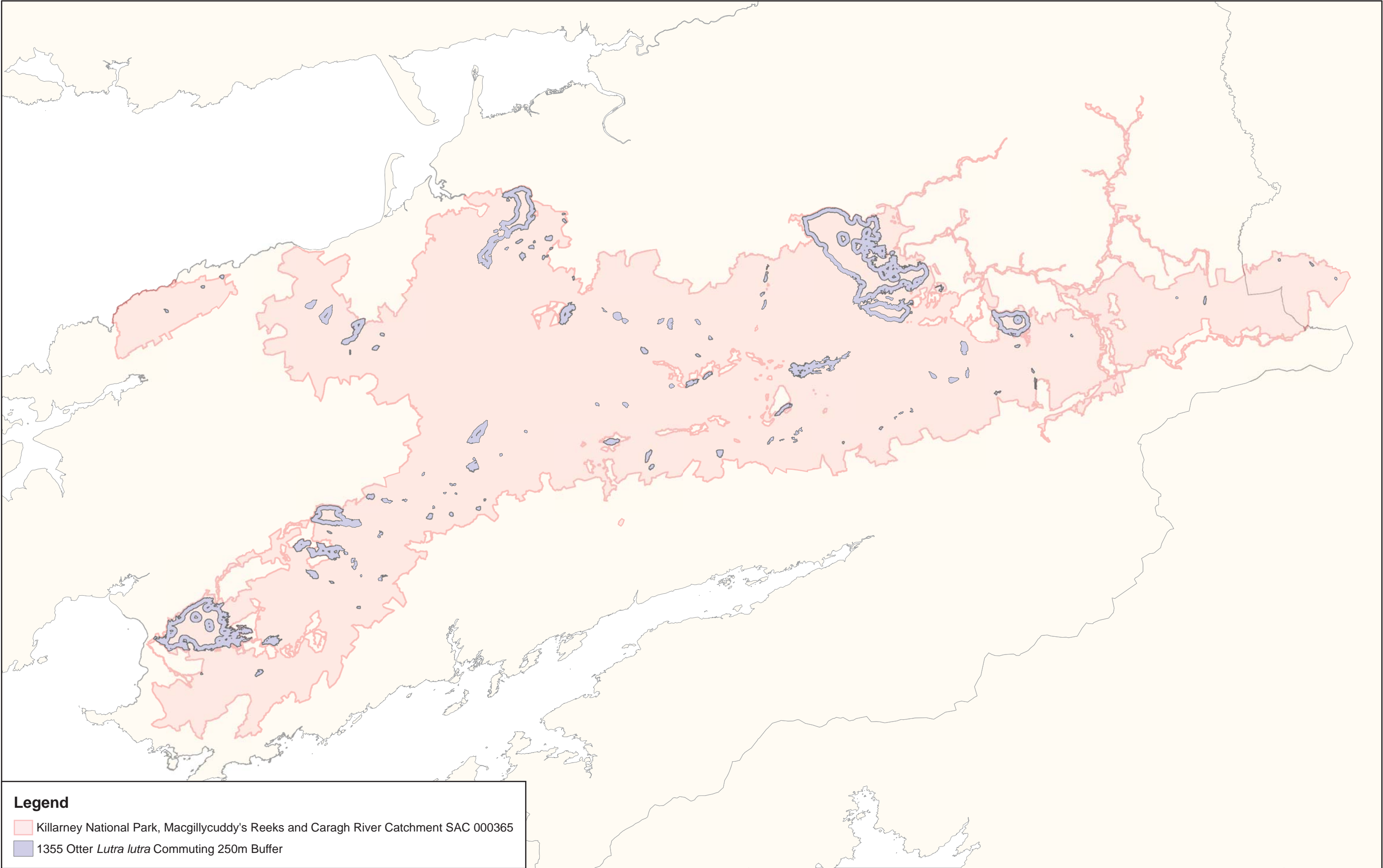
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Legend

- Killarney National Park, Macgillicuddy's Reeks and Caragh River Catchment SAC 000365
- 1355 Otter *Lutra lutra* Commuting 250m Buffer



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MAP 11:
**KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S
REEKS AND CARAGH RIEKS RIVER CATCHMENT SAC**
CONSERVATION OBJECTIVES
OTTER

Map to be read in conjunction with the NPWS Conservation Objectives Document.

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0

3

6

9

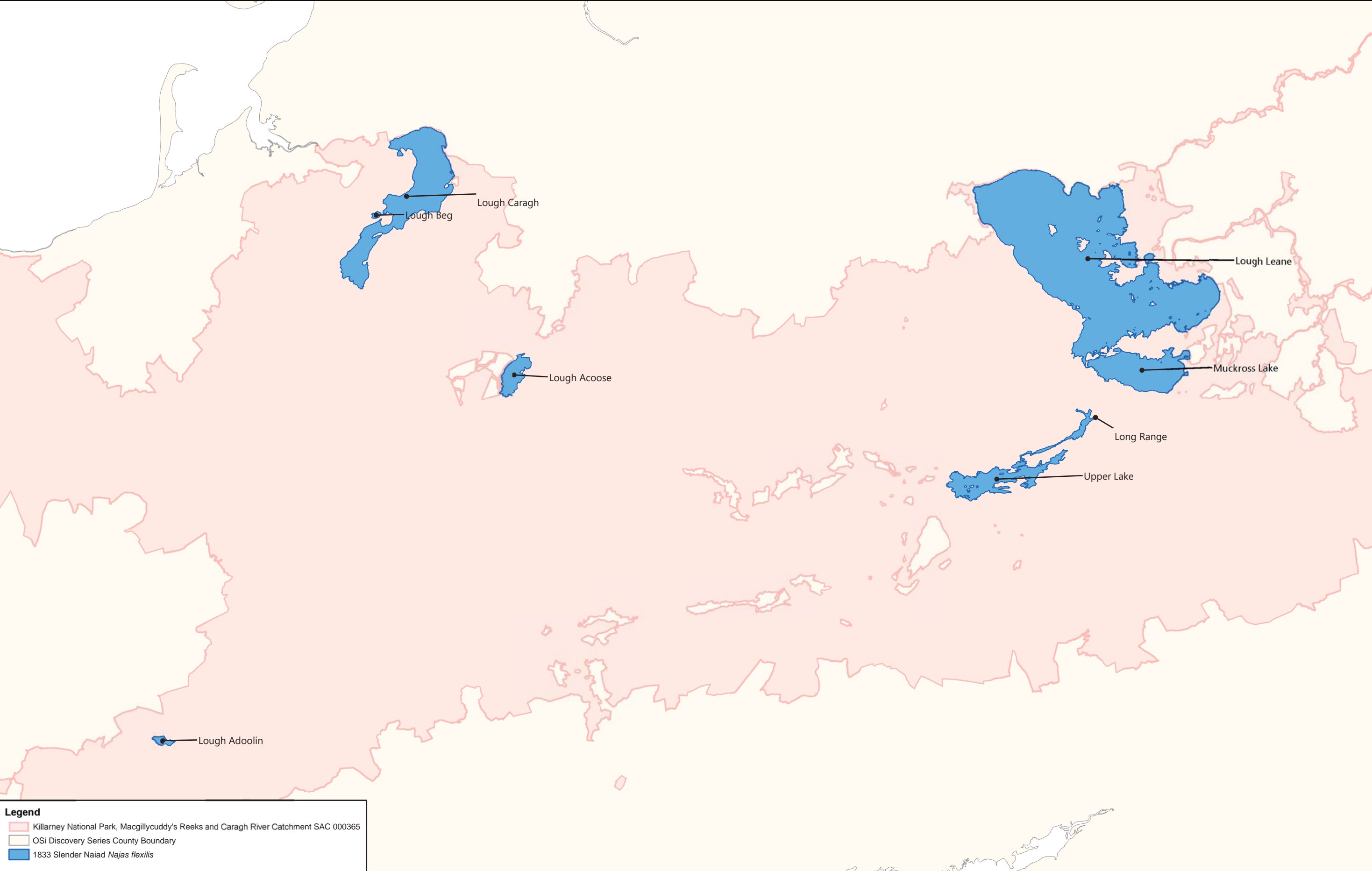
12 km

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Legend

Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC 000365

OSi Discovery Series County Boundary

1833 Slender Naiad *Najas flexilis*



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MAP 12:
KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S
REEKS AND CARAGH REEKS RIVER CATCHMENT SAC
CONSERVATION OBJECTIVES
SLENDER NAIAD

Map to be read in conjunction with the NPWS Conservation Objectives Document.

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036912 km

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