National Parks and Wildlife Service

Conservation Objectives Series

Bandon River SAC 002171



An Roinn Cultúir, Oidhreachta agus Gaeltachta Department of Culture, Heritage and the Gaeltacht National Parks and Wildlife Service, 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

002171	Bandon River SAC
1029	Freshwater Pearl Mussel Margaritifera margaritifera
1096	Brook Lamprey Lampetra planeri
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
91E0	Alluvial forests with Œ) ັ∙ℋ႞ັ௸[∙æand ئæ¢ðj ັ•Á∕¢&^/•ð[¦ (Alno-Padion, Alnion incanae, Salicion albae)E

Supporting documents, relevant reports & publications

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

NPWS Docur	nents				
Year :	2004				
Title :	The status and distribution of lamprey and shad in the Slaney and Munster Blackwater SACs				
Author :	King, J.J.; Linnane, S.M.				
Series :	Irish Wildlife Manuals, No. 14				
Year :	2005				
Title :	Notes relating to Margaritifera margaritifera in the Bandon River. Visited August 19th, 2005				
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 :	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: Monitoring of the Freshwater Pearl Mussel in the Bandon				
Author :	Moorkens, E.A.				
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 Bandon/Caha River Catchment. September 2009				
Author :	Conservation Services				
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 Manuals, No. 46				
Year :	2010				
Title :	Second Draft Bandon Freshwater Pearl Mussel Sub-basin Management Plan (2009-2015). March 2010				
Autnor :	NPWS				
Series :	Unpublished document to the Department of Environment, Heritage and Local Government				
Tear:	2010				
	Bandon Catchment, Co. Cork. (SWRBD) June 2009				
Sorios ·	Unpublished report to NPWS				
Year ·	2012				
Title ·	Ireland Red List No. 8: Bryonbytes				
Author ·	Lockhart N. Hodgetts N. Holyoak D				
Sorios :	Lochian, N., Hougells, N., Hoiyoak, D.				
001103.					

Version 1

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 Manuals, No. 71		
Year :	2013		
Title :	The status of EU protected habitats and species in Ireland. Volume 3. Species assessments		
Author :	NPWS		
Series :	Conservation assessments		
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 List Series, NPWS		
Year :	2018		
Title :	Electrofishing survey to identify fish hosts for the freshwater pearl mussel <i>Margaritifera margaritifera</i> in 12 populations in the Republic of Ireland. 2017 Survey		
Author :	Johnston, P.M.; Moorkens, E.A.		
Series :	Unpublished report to NPWS		
Year :	in prep.		
Title :	The monitoring and assessment of four EU Habitats Directive Annex I woodland habitats		
Author :	Daly, O.H.; O'Neill, F.H.; Barron, S.J.		
Series :	Irish Wildlife Manuals		
Year :	in prep.		
Title :	The status of EU protected habitats and species in Ireland (2013-2018). Species assessments		
Author :	NPWS		
Series :	Conservation assessments		

Other References

Year :	1998
Title :	Longitudinal variation in abundance of a freshwater pearl mussel <i>Margaritifera margaritifera</i> population in relation to riverine habitats
Author :	Gittings, T.; O'Keefe, D.; Gallagher, F.; Finn, J.; O'Mahony, T.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 98B(3): 171-178
Year :	1998
Title :	Distribution and abundance of <i>Lampetra planeri</i> populations in the Peene drainage (NE Germany) in relation to isolation and habitat conditions
Author :	Waterstraat, A.; Krappe, M.
Series :	Italian Journal of Zoology, 65: 137-143
Year :	2000
Title :	A report on the removal and relocation of pearl mussels from a stretch of the Bandon River, approximately 220m long, immediately upstream of the Long Bridge in Dunmanway prior to lowering of the eastern river bank in that stretch as part of the Bandon River (Dunmanway) Drainage Scheme
Author :	Ross, E.
Series :	Report to the Office of Public Works, Engineering Services Division

Year :	2000			
Title :	An assessment of the survival of freshwater pearl mussels [<i>Margaritifera margaritifera</i> (L.)] one month after their upstream relocation, prior to commencement of proposed engineering works associated with the Bandon River (Dunmanway) Drainage Scheme. (August 2000)			
Author :	Ross, E.			
Series :	Report to the Office of Public Works, Engineering Services Division			
Year :	2001			
Title :	A report on the commencement of a monitoring programme for pearl mussels [<i>Margaritifera margaritifera</i> (L.)] in the Bandon River, downstream of the Long Bridge at Dunmanway, County Cork, as part of the mitigation measures associated with the Bandon River (Dunmanway) Drainage Scheme. (February 2001)			
Author :	Ross, E.			
Series :	Report to the Office of Public Works, Engineering Services Division			
Year :	2001			
Title :	An investigation of a section of the Bandon River channel at a proposed crossing point associated with the construction of a 110kV electricity transmission line through the Bandon River Special Area of Conservation. (June 2001)			
Author :	Ross, E.			
Series :	Report to ESBI Engineering Ltd.			
Year :	2001			
Title :	An assessment of the survival of freshwater pearl mussels [<i>Margaritifera margaritifera</i> (L.)] one year after their upstream relocation, prior to commencement of proposed engineering works associated with the Bandon River (Dunmanway) Drainage Scheme. (July 2001)			
Author :	Ross, E.			
Series :	Report to the Office of Public Works, Engineering Services Division			
Year :	2001			
Title :	A report on a monitoring exercise carried out during June 2001, on pearl mussels [<i>Margaritifera margaritifera</i> (L.)] in the Bandon River, downstream of the Long Bridge at Dunmanway, County Cork, as part of the mitigation measures associated with the Bandon River (Dunmanway) Drainage Scheme. (November 2001)			
Author :	Ross, E.			
Series :	Report to the Office of Public Works, Engineering Services Division			
Year :	2002			
Title :	Reversing the habitat fragmentation of British woodlands			
Author :	Peterken, G.			
Series :	WWF-UK, London			
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, Lampetra fluviatilis, L. planeri and Petromyzon marinus			
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 Callitricho-Batrachion vegetation			
Author :	Hatton-Ellis, T.W.; Grieve, N.			
Series :	Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough			

	2003				
Title :	A report on the monitoring of pearl mussels [<i>Margaritifera margaritifera</i> (L.)] carried out during the period August 30th to September 9th, 2002, in the Bandon River, downstream of the Long Bridge at Dunmanway, County Cork, as part of the mitigation measures associated with the Bandon River (Dunmanway) Drainage Scheme. (March 2003)				
Author :	Ross, E.				
Series :	Report to the Office of Public Works, Engineering Services Division				
Year :	2005				
Title :	An assessment of the survival of freshwater pearl mussels [Margaritifera margaritifera (L.)] four years and eleven months after their upstream relocation prior to engineering works associated with The Bandon River (Dunmanway) Drainage Scheme. June 29th 2005				
Author :	Ross, E.				
Series :	Report to the Office of Public Works, Engineering Services Division				
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 :	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 :	2012				
Title :	Rare and threatened bryophytes of Ireland				
Author :	Lockhart, N.; Hodgetts, N.; Holyoak, D.				
Series :	National Museums Northern Ireland				
Year :	2013				
Title :					
THUE.	Aspects of brook lamprey (Lampetra planeri Bloch) spawning in Irish waters				
Author :	Aspects of brook lamprey (<i>Lampetra planeri</i> Bloch) spawning in Irish waters Rooney, S.M.; O'Gorman, N.M.; Green, F.; King, J.J.				
Author : Series :	Aspects of brook lamprey (<i>Lampetra planeri</i> Bloch) spawning in Irish waters Rooney, S.M.; O'Gorman, N.M.; Green, F.; King, J.J. Biology and Environment: Proceedings of the Royal Irish Academy, 113B(1): 13-25				
Author : Series : Year :	Aspects of brook lamprey (<i>Lampetra planeri</i> Bloch) spawning in Irish waters Rooney, S.M.; O'Gorman, N.M.; Green, F.; King, J.J. Biology and Environment: Proceedings of the Royal Irish Academy, 113B(1): 13-25 2013				
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Author :Series :Year :Title :Author :	Aspects of brook lamprey (<i>Lampetra planeri</i> Bloch) spawning in Irish waters Rooney, S.M.; O'Gorman, N.M.; Green, F.; King, J.J. Biology and Environment: Proceedings of the Royal Irish Academy, 113B(1): 13-25 2013 Management strategies for the protection of high status water bodies Ní Chatháin, B.; Moorkens, E.; Irvine, K. Strive Report Series No. 99. EPA, Wexford 2013 Interpretation manual of European Union habitats- Eur 28 European Commission- DG Environment European Commission 2013 Bandon River: Freshwater Pearl Mussel findings during South West CFRAMS Field Survey Work. 26th April 2013 Ecofact Environmental Consultants Unpublished report to the Office of Public Works 2014 Assessing near-bed velocity in a recruiting population of the endangered freshwater pearl mussel (<i>Margaritifera margaritifera</i>) in Ireland Moorkens, E.; Killeen, I.				

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 :	Environmental Protection Agency, Wexford			
Year :	2015			
Title :	River engineering works and lamprey ammocoetes; impacts, recovery, mitigation			
Author :	King, J.J.; Wightman, G.D.; Hanna, G.; Gilligan, N.			
Series :	Water and Environment Journal, 29: 482-488			
Year :	2015			
Title :	Common standards monitoring guidance for freshwater fauna. Version October 2015			
Author :	JNCC			
Series :	Joint Nature Conservation Committee, Peterborough			
Year :	2015			
Title :	Observation and assessment of a section of the Bandon River downstream of the Long Bridge in Dunmanway, Co. Cork, following bank clearance works. November 2nd, 2015			
Author :	Ross, E.			
Series :	Unpublished report to the Office of Public Works			
Year :	2015			
Title :	Contrasting population genetic structure among freshwater-resident and anadromous lampreys: the role of demographic history, differential dispersal and anthropogenic barriers to movement			
Author :	Bracken, F.S.A.; Rus Hoelzel, A.; Hume, J.B.; Lucas, M.C.			
Series :	Molecular Ecology, 24: 1188-1204			
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 :	Report on damage to the riparian and aquatic habitat in the Bandon River SAC downstream of the Long Bridge in Dunmanway arising from OPW bank clearance works. Site visits on April 9th and 13th, 2016			
Author :	Ross, E.			
Series :	Unpublished report to the Office of Public Works			
Year :	2016			
Title :	Report: Site visit on May 26th, 2016, to the location of OPW bank clearance works on the Bandon River at Long Bridge, Dunmanway, Co. Cork, with observations on potential mitigation measures			
Author :	Ross, E.			
Series :	Unpublished report to the Office of Public Works			
Year :	2016			
Title :	Irish Vegetation Classification: Technical Progress Report No. 2			
Author :	Perrin, P.			
Series :	Report submitted to National Biodiversity Data Centre			
Year :	2017			
Title :	Water Quality in Ireland 2010-2015			
Author :	Fanning, A.; Craig, M.; Webster, P.; Bradley, C.; Tierney, D.; Wilkes, R.; Mannix, A.; Treacy, P.; Kelly, F.; Geoghegan, R.; Kent, T.; Mageean, M.			
Series :	Environmental Protection Agency, Wexford			

Year :	2017		
Title :	2017 survey of Margaritifera condition in the Bandon River, County Cork		
Author :	Moorkens, E.		
Series :	Unpublished report to the Office of Public Works		
Year :	2017		
Title :	Survey of the freshwater pearl mussel population in a section of the Bandon River downstream of the Long Bridge, Dunmanway, arising from bank clearance works carried out by the OPW in Autumn 2015		
Author :	Ross, E.		
Series :	Unpublished report to the Office of Public Works		
Year :	2018		
Title :	2018 survey of Margaritifera condition in the Bandon River, County Cork		
Author :	Moorkens, E.		
Series :	Unpublished report to the Office of Public Works		

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Spatial data sources

Year :	Revision 2010
Title :	National Survey of Native Woodlands 2003-2008. Version 1
GIS Operations :	QI selected; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	91E0 (map 2)
Year :	Revision 2012
Title :	Margaritifera Sensitive Areas data
GIS Operations :	Relevant catchment boundaries identified. Expert opinion used as necessary to resolve any issues arising
GIS Operations : Used For :	Relevant catchment boundaries identified. Expert opinion used as necessary to resolve any issues arising 1029 (map 3)
GIS Operations : Used For : Year :	Relevant catchment boundaries identified. Expert opinion used as necessary to resolve any issues arising 1029 (map 3) 2018
GIS Operations : Used For : Year : Title :	Relevant catchment boundaries identified. Expert opinion used as necessary to resolve any issues arising 1029 (map 3) 2018 NPWS rare and threatened species database
GIS Operations : Used For : Year : Title : GIS Operations :	Relevant catchment boundaries identified. Expert opinion used as necessary to resolve any issues arising 1029 (map 3) 2018 NPWS rare and threatened species database Dataset created from spatial references in database records. Expert opinion used as necessary to resolve any issues arising

3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation

To restore the favourable conservation condition of Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation in Bandon River 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 Bandon River SAC used a broad interpretation and the habitat's full distribution and sub-types are not yet documented, but bryophyte assemblages are known to occur. <i>Ranunculus</i> sp. is excessively abundant in the Bandon and Caha, and indicative of hydromorphological and water quality impacts. Note: rooted macrophytes should be absent or trace (<5% cover) in freshwater pearl mussel (<i>Margaritifera margaritifera</i>) habitat. The SAC covers part of the Bandon freshwater pearl mussel population. The freshwater pearl mussel (species code 1029) conservation objective for this habitat (habitat code 3260) in the SAC because the mussel requires environmental conditions closer to natural background levels. Excessive rooted macrophyte growth is significantly impacting the mussel habitat in the Bandon system
Habitat distribution	Occurrence	No decline, subject to natural processes	Further study of Irish rivers is needed to interpret the broad description of habitat 3260 which covers from upland bryophyte/macroalgal dominated to lowland depositing rivers with pondweeds and starworts (European Commission, 2013). The Bandon and Caha are spate rivers. In the SAC, the Bandon flows through residual alluvial woodland with some braided channels, both of which are rare in Ireland, as well as open areas of floodplain. The wide range of hydromorphological conditions creates a range of river habitats from riffles through to ponded sections. Bryophytes are likely to have dominated the natural aquatic vegetation given the naturally nutrient-poor and shaded nature of the river, with vascular plants found in slow-flowing and ponded areas
Hydrological regime: river flow	Metres per second	Maintain/restore appropriate hydrological regimes	High conservation value sub-types are associated with natural hydrological regimes. 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. The Bandon's braided channels in the alluvial woodland are, however, likely to have a less variable flow regime. The hydrological regime of the Bandon and Caha may have been altered by land drainage, flood protection and other morphological changes. Note: hydrological changes are a threat to the freshwater pearl mussel (<i>Margaritifera margaritifera</i>) in the Bandon system. See the conservation objective for the freshwater pearl mussel (species code 1029) in this volume
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

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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 of rooted plant communities. The braided channels in the Bandon have sands and gravels that are suitable habitat for juvenile freshwater pearl mussels (<i>Margaritifera</i> <i>margaritifera</i>). Increased loads of fine organic and inorganic particles arising from land drainage, river bank collapse and other activities has increased the fine sediment load to the Bandon and Caha. Note: increased fine sediment is contributing to the unfavourable status of freshwater pearl mussel in the Bandon system
Water quality	Various	Restore appropriate water quality to support the natural structure and functioning of the habitat	The specific targets may vary among sub-types. High status targets apply to freshwater pearl mussel (<i>Margaritifera margaritifera</i>) habitat in the Bandon and Caha (see S.I. 296 of 2009) and therefore, to all of the SAC. The Bandon River is naturally nutrient- poor and requires Water Framework Directive high status, in terms of nutrient and oxygenation standards, and EQRs (Ecological Quality Ratios) for macroinvertebrates and phytobenthos. 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; Fanning et al., 2017) and Ní Chatháin et al. (2013). The three stations (one in Caha, two in Bandon) monitored in the SAC in 2015 had Q values of Q4 (Good Status)
Typical species	Occurrence	Typical species of the relevant habitat sub-type should be present and in good condition	Typical species have not been fully defined, but may include higher plants, bryophytes, algae and invertebrates. Bryophytes associated with tree roots/ rocks in the SAC include <i>Fontinalis antipyretica</i> in slack flow, and <i>F. squamosa, Platyhypnidium</i> <i>riparioides, Leptodictyum riparium, Brachythecium</i> <i>rivulare</i> and <i>Chiloscyphus polyanthos</i> in moderate flows. <i>Riccardia chamedryfolia</i> and <i>Fissidens</i> <i>crassipes</i> are found at the Long Bridge. No Red Listed bryophyte species (Lockhart et al., 2012) are known from the SAC. <i>Littorella uniflora, Elatine</i> <i>hexandra</i> (Near Threatened; Wyse Jackson et al., 2016), <i>Potamogeton natans, Myriophyllum</i> <i>alterniflorum</i> and at least four <i>Callitriche</i> spp. have been recorded; deeper pools support <i>Nuphar lutea</i> and <i>Menyanthes trifoliata</i> . As noted, <i>Ranunculus</i> sp. (likely <i>penicillatus</i>) is excessively abundant and indicative of hydromorphological and water quality impacts
Floodplain connectivity: area	Hectares	The area of active floodplain at and upstream of the habitat should be maintained/restored	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). Extensive floodplains are found in Bandon River SAC, with both open habitats and residual alluvial woodland

ea and condition	Restore the area and condition of fringing habitats necessary to support the habitat and its sub-types	Riparan habitats (e.g., woodialities and wetahids) are integral to the structure and functioning of rivers, even where not part of a floodplain. Fringing habitats can contribute to the aquatic food web (e.g. allochthonous matter such as leaf fall), provide habitat for certain life-stages of fish, birds and aquatic invertebrates, aid in the settlement of fine sediments, protect banks from erosion and contribute to nutrient cycling. Shade may be important in suppressing algal growth and moderating temperatures. Equally, fringing habitats are dependent on rivers, particularly their water levels, and support wetland communities and species of conservation concern. See Mainstone et al. (2016). Alluvial forests (habitat 91E0*) occurs south of the Long Bridge and requires further restoration following clearance. Freshwater marsh communities with <i>Caltha palustris</i> and <i>Mentha</i> <i>aquatica</i> also occur. Heath in mosaic with wet grassland and exposed rock occurs north of the Long Bridge
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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 Bandon River 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, at least 27.7ha for the sub-site (Milleenanannig, NSNW site code 1306) surveyed. See map 2 for surveyed area	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus</i> <i>excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae)* occur in an area of braided river channels and islands downstream of the Long Bridge in Bandon River SAC. As part of the National Survey of Native Woodlands (NSNW; Perrin et al., 2008), the sub-site Milleenanannig (NSNW site code 1306) was surveyed and mapped and the minimum area of alluvial forest in the SAC is estimated to be 27.7ha. Map 2 shows the surveyed area classified as 91E0* (27.7ha). Approximately 0.28ha of 91E0* habitat downstream of the Long Bridge requires further restoration following bank clearance in 2015 (after Ross, 2017). 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 surveyed woodland location is shown on map 2	Distribution based on Perrin et al. (2008). 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 a constraints may restrict expansion	
Woodland structure: cover and height	Percentage; metres; centimetres	Total canopy cover at least 30%; median canopy height at least 7m; native shrub layer cover 10-75%; native herb/dwarf shrub layer cover at least 20% and height at least 20cm; bryophyte cover at least 4%	The target aims for a diverse structure with a canopy containing mature trees, shrub layer with semi-mature trees and shrubs, and well-developed field layer (herbs and dwarf shrubs) and ground layer (bryophytes). Assessment criteria are described in Daly et al. (in prep.) and O'Neill and Barron (2013)	
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 the Irish Vegetation Classification (Perrin, 2016; www.biodiversityireland.ie/projects/national- vegetation-database/irish-vegetation-classification)	
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes of target species for 91E0* woodlands and other native tree species occur in adequate proportions to ensure survival of woodland canopy	The target species for 91E0* are alder (<i>Alnus glutinosa</i>), ash (<i>Fraxinus excelsior</i>) and willows (<i>Salix</i> spp.). Assessment criteria are described in Daly et al. (in prep.) and O'Neill and Barron (2013) in	
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. The Milleenanannig sub-site (NSNW site code 1306) is on a floodplain and, in wetter months, channels fill and create a series of islands (Perrin et al., 2008)	
Woodland structure: dead wood	Number per hectare	At least 19 stems/ha of dead wood of at least 20cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem. Dead wood comprises old senescent trees, standing dead trees, fallen dead wood (including large branches) and rotten stumps of any tree species. Assessment criteria are described in Daly et al. (in prep.) and O'Neill and Barron (2013)	

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Woodland structure: veteran trees	Number per hectare	No decline	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 listed and other rare or localised species	
Woodland structure: indicators of overgrazing	Occurrence	All five indicators of overgrazing absent	There are five indicators of overgrazing within 91E0*: topiary effect on shrubs and young trees; browse line on mature trees; abundant dung; sever recent bark stripping; and trampling (Daly et al., in prep.)	
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover at least 90% of canopy; target species cover at least 50% of canopy	The target species for 91E0* are alder (<i>Alnus glutinosa</i>), ash (<i>Fraxinus excelsior</i>) and willows (<i>Salix</i> spp.) (Daly et al., in prep.; O'Neill and Barron, 2013). Species present reported in Perrin et al. (2008) and NPWS internal files	
Vegetation composition: typical species	Occurrence	At least 1 target species for 91E0* woodlands present; at least 6 positive indicator species for 91E0* woodlands present	A variety of typical native species should be present, depending on woodland type. The target species for 91E0* are alder (<i>Alnus glutinosa</i>), ash (<i>Fraxinus</i> <i>excelsior</i>) and willows (<i>Salix</i> spp.). Positive indicator species for 91E0* are listed in Daly et al. (in prep.) and O'Neill and Barron (2013). Species present reported in Perrin et al. (2008) and NPWS internal files	
Vegetation composition: negative indicator species	Occurrence	Negative indicator species cover not greater than 10%; regeneration of negative indicator species absent	Negative indicator species (i.e. any non-native species, including herbaceous species) should be absent or under control. In general, the following are the most common non-native invasive species in 91E0* woodlands: sycamore (<i>Acer pseudoplatanus</i>), beech (<i>Fagus sylvatica</i>) and horse-chestnut (<i>Aesculus hippocastanum</i>) (Daly et al., in prep.)	
Vegetation composition: problematic native species	Percentage	Cover of common nettle (<i>Urtica dioica</i>) less than 75%	Common nettle (<i>Urtica dioica</i>) is a positive indicator species for 91E0* but, in some cases, it may become excessively dominant. Increased light and nutrient enrichment are factors which favour proliferation of common nettle (Daly et al., in prep.)	

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1029 Freshwater Pearl Mussel Margaritifera margaritifera

To restore the favourable conservation condition of Freshwater Pearl Mussel (*Margaritifera margaritifera*) in Bandon River SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Kilometres	Restore distribution to 12.2km. See map 3	The conservation objective applies to the Bandon freshwater pearl mussel population. The braided channels downstream of the Long Bridge are unique in Ireland having high mussel density in a wet woodland. Mussels are widespread in the Bandon catchment (from the upper Bandon downstream of Cullenagh Lake to above Inishannon and in the Caha, Blackwater and other smaller tributaries); however, only part of the population and habitat is within the SAC. As a result, the objective is restricted to the portion of the population and habitat in the Caha and main channel Bandon within the SAC. Full baseline distribution and abundance mapping has not been completed in the Bandon catchment. Most of the survey work to date was for Dunmanway Drainage Scheme or by NPWS staff and is summarised in NPWS (2010). The target is for the species to be sufficiently widespread to maintain itself on a long-term basis as a viable component of the Bandon system. See NPWS (2010) for further information
Population size	Number of adult mussels	Restore population to at least 50,000 adult mussels	The absence of baseline data and the size of the Bandon system make it difficult to estimate the population size. Moorkens (2009) estimated the population to be at least 50,000, noting that this was likely to be conservative. Gittings et al. (1998) estimated a population of 14,194 in a 1.6km stretch near the Long Bridge, Dunmanway. Ross (2017) estimated 14,332 mussels in a 580m survey stretch downstream of the Long Bridge. Mussels were abundant in places, with densities of up to 75/m ² (Ross, 2005). Ecofact (2013) recorded variable densities of up to 20/m ² . NPWS (2013, in prep.) assumed the Bandon population had declined by 18% 2007-2012 and by 18%-28% 2013-2018. Surveys following 2015 bank clearance have demonstrated significant population decline (Ross, 2015, 2016, 2017; Moorkens, 2017, 2018). The target is for the species to be sufficiently abundant to maintain itself on a long-term basis as a viable component of the Bandon system
Population structure: recruitment	Percentage per size class	Restore to at least 20% of population no more than 65mm in length; and at least 5% of population no more than 30mm in length	Mussels ≤65mm are 'young mussels' and found buried in the substratum or beneath adult mussels. Mussels ≤30mm are 'juvenile mussels' and are always buried in the substratum. See the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 and I.S. EN 16859:2017. The Bandon consistently fails the targets. Gittings et al. (1998) measured 3 juveniles (n=2,017). Ross (2000) found a range of 37.9- 126mm (n=331). In Dec. 2000, transects had young mussels of 35.9-54.8mm, but in 2001 the smallest live mussel was 74.8mm and 11 dead young mussels were recorded (Ross, 2001). NPWS measured mussels of 60 to <120mm in the Caha in 2002. No juveniles were found in 10 search quadrats in 2017 and few young (smallest=36.8mm) (Ross, 2017). The Bandon population is unsustainable owing to lack of survival of juvenile mussels. 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 Bandon system

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 targets were assessed as 'unknown' in 2009 (Moorkens, 2009; NPWS, 2010). Ross (2017) recorded an overall decline of 28% in numbers across 9 transects between 2005 and 2017. Large numbers of dead and moribund mussels, as well as high stress levels, have been recorded downstream of the Long Bridge in 2017 and 2018 (Ross, 2017; Moorkens, 2017, 2018). 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 Bandon system
Suitable habitat: extent	Kilometres	Maintain habitat extent at 12.2km in the Bandon system (see map 3) and any additional stretches necessary for salmonid spawning	The full extent of the mussel habitat in the Bandon system is not fully mapped, but within the SAC it is considered to be from the SAC boundary on the Caha to below Caha Bridge and, on the Bandon main channel, from just above the Caha confluence to below the braided channel and Milleenanannig. The mussel habitat is impacted by hydromorphological change, sedimentation and nutrient enrichment (Moorkens, 2009; NPWS, 2010). Bank clearance in 2015 has led to severe degradation of the habitat downstream of the Long Bridge (Ross, 2015, 2016, 2017; Moorkens, 2017, 2018). 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 Bandon system
Suitable habitat: condition	Kilometres	Restore condition of suitable habitat	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 habitat typically overlaps with mussel habitat. 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. Mussel and fish habitat availability is determined by flow and substratum and is highly sensitive to hydromorphological, sedimentation and enrichment pressures from throughout the catchment (map 3). See I.S. EN 16859:2017. Mussel habitat is widespread in the Bandon system and within the SAC, but is in unfavourable condition as a result of nutrient enrichment and sedimentation. 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 Bandon 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 Bandon system failed the macroinvertebrate target, but passed the diatom target; however, confidence in the diatom result was low owing to abundant <i>Ranunculus</i> shading cobbles and impairing sampling (Conservation Services, 2009; Ní Chatháin, 2010; 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 Bandon system

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 Bandon failed both targets in 2009 (NPWS, 2010). Filamentous algal cover was generally low in the mussel habitat, where very high biomass of <i>Ranunculus</i> was typical. The algal cover did not exceed 25% in mussel habitat on sampling occasions in 2009 (Conservation Services, 2009; Ní Chatháin, 2010). Removal of riparian shade in 2015 has led to increased algal growth (Ross, 2017). Extremely high <i>Ranunculus</i> cover has frequently been recorded in mussel habitat since 1998 and has increased since bank clearance (Gittings et al., 1998; Ross, 2000, 2001, 2005, 2017; Conservation Services, 2009; Ní Chatháin, 2010; NPWS, 2010; Moorkens, 2017, 2018). 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 Bandon system
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 Bandon failed the target for the Sub-basin Management Plan, with moderate to heavy sedimentation in the mussel habitat within the SAC (Conservation Services, 2009; NPWS, 2010). Sedimentation of the mussel habitat provides a rooting medium for macrophytes (<i>Ranunculus</i>) in the Bandon. Severe, sustained, sedimentation resulted from bank clearance works in 2015 (Ross, 2015, 2016, 2017; Moorkens, 2017, 2018). Sufficient survival 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 Bandon system
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. See I.S. EN 16859:2017. Redox could not be measured in the Bandon in 2009, owing to high water levels and poor visibility (Moorkens, 2009; NPWS, 2010). In 2017, within the bank clearance zone, average redox ranged from 21.6% to 25.4%, while upstream it was 16.2-18.7% (Moorkens, 2017). In 2018, upstream of bank clearance average redox was 19.4%, while at and downstream average redox ranged from 21% to 24.2% (Moorkens, 2018). 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 Bandon system
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 is the other key 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 sediments 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. Groundwater inflow to a river contributes to water-cycling. See Moorkens and Killeen (2014) and I.S. EN 16859:2017 for further information. 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 Bandon system

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. No glochidia were observed in 2009, but were found on both juvenile salmon and trout in Apr 2017 (Johnston, 2009; NPWS, 2010; Johnston and Moorkens, 2018)
Fringing habitat: area and condition	Hectares	Restore the area and condition of fringing habitats necessary to support the population	Semi-natural and natural riparian habitats, including those along lake fringes, even where they do not form part of a natural floodplain, are an integral part of the structure and functioning of river systems. Open wetlands, such as wet heath and blanket bog, are particularly critical to the hydrological regime of mussel rivers. Fringing habitats assist in the settlement of fine suspended material, protect banks from erosion and contribute to nutrient cycling, as well as contributing to the aquatic food web (e.g. allochthonous matter from poor fens and flushes) and providing habitat (refuge and resources) for life- stages of fish, birds and aquatic invertebrates. 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 Bandon system

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1096 Brook Lamprey *Lampetra planeri*

To maintain the favourable conservation condition of Brook Lamprey (*Lampetra planeri*) in Bandon River 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 lampreys' upstream migration, thereby limiting species scope to move and possibly restricting access to spawning areas. In the case of the brook lamprey (<i>Lampetra planeri</i>), a non-migratory form, barriers can lead to genetic isolation, commonly within the same channel of whatever size (Waterstraat and Krapp, 1998; Espanhol et al., 2007; Bracken et al., 2015)
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)
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density at least 5/m²	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 more than 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	Extent of suitable areas of fine sediment and number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Silting habitat is essential for larval lamprey and they can be severely impacted by sediment removal. Recovery can be rapid and newly-created habitat can be rapidly colonised (King et al., 2015). However, it is vital that such sedimenting habitats are retained. JNCC (2015) recommended 66% positive sites at catchment level. Occupancy in excess of 50% of sites is the recommended target for Irish catchments based on IFI (unpublished data), Sugiyama and Goto (2002) and King and Linnane (2004)

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Legend Bandon River SAC 002171 1029 Freshwater Pearl Mussel - I 1029 Freshwater Pearl Mussel - I 1029 Freshwater Pearl Mussel - I 1029 Freshwater Pearl Mussel - I	Argaritifera margaritifera Suitable habitat target Argaritifera margaritifera Suitable habitat target		
An Roinn Cultúir, Oidhreachta agus Gaeltachta Department of Culture, Heritage and the Gaeltacht	MAP 3: BANDON RIVER SAC CONSERVATION OBJECTIVES FRESHWATER PEARL MUSSEL	SITE CODE: SAC 002171; version 3.0. CO. CORK. 0 0.75 1.5 2.25 3 3.75 km	The mapped boundaries are of an indicative and general nature only. Bounda Ordnance Survey of Ireland Licence No EN 0059216. © Ordnance Survey of Ireland Licence No EN 0059216. © Ordnance Su Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar i comharthaithe. Suirbhéarachta Ordonáis na hÉireann Ceadúnas Uimh EN 0059216. © S
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