



Sampling Fish for the Water Framework Directive

Lakes 2010

Lough Shindilla



Iascach Intíre Éireann
Inland Fisheries Ireland

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1.1 Introduction

Lough Shindilla (Plate 1.1, Fig. 1.1) is the uppermost lake on the Screebe system in Co. Galway, located approximately 0.75km west of Maam Cross. The lake has a surface area of 65.3ha, a mean depth >4m, a maximum depth of 22m and falls into typology class 4 (as designated by the EPA for the Water Framework Directive), i.e. deep (>4m), greater than 50ha and low alkalinity (<20mg/l CaCO₃).

Lough Shindilla is located in the Maumturk Mountains Special Area of Conservation (SAC). Most of the mountains in the SAC exceed 600m in height and the majority of the land within the site lies above an altitude of 250m. The main bedrock in the south is made up of quartzite and in the north of the SAC the bedrock is generally comprised of shales and slates (NPWS, 2006).

The site is a SAC for containing blanket bog, lowland oligotrophic lakes, alpine heath, siliceous rocky and Rhynchosporion, all habitats listed on Annex I of the E.U. Habitats Directive (NPWS, 2006). The SAC is also selected for containing slender naiad and Atlantic salmon, both species listed on Annex II of the same Directive. Species listed in the Red Data Book which are located in the SAC include the Irish hare and the common frog. Peregrine, a species listed on Annex I of the EU Birds Directive also occur within the SAC (NPWS, 2006).

Oligotrophic lakes are well represented within the Maumturk Mountains SAC, occurring mainly to the south-east near Maam Cross. The main lakes within the SAC are Lough Shindilla, Loughanillaun, Lough Nambrackboy, Lough Shannagrena, Maumwee Lough and Lehanagh Lough. Most of these are good quality, small to medium sized systems that contain typical oligotrophic aquatic species, including quillwort (*Isoetes lacustris*), pipewort (*Eriocaulon aquaticum*), water lobelia (*Lobelia dortmanna*), shoreweed (*Littorella uniflora*) and water milfoil (*Myriophyllum alterniflorum*).

Damaging activities and threats to the Maumturk Mountains SAC include overgrazing, peat-cutting and afforestation. Grazing, in particular by sheep, is quite severe within the site and has resulted in the erosion of both lowland and mountain blanket bog (NPWS, 2006).

The lake holds a stock of brown trout and gets the occasional run of sea trout and salmon (O'Reilly, 2007). Lough Shindilla was previously surveyed in 2007 as part of the WFD surveillance monitoring programme (Kelly and Connor, 2007). During this survey Arctic char and brown trout were found to be the dominant species present in the lake. Adult salmon, minnow and eels were also captured.



Plate 1.1. Lough Shindilla

Shindilla Lough, Galway

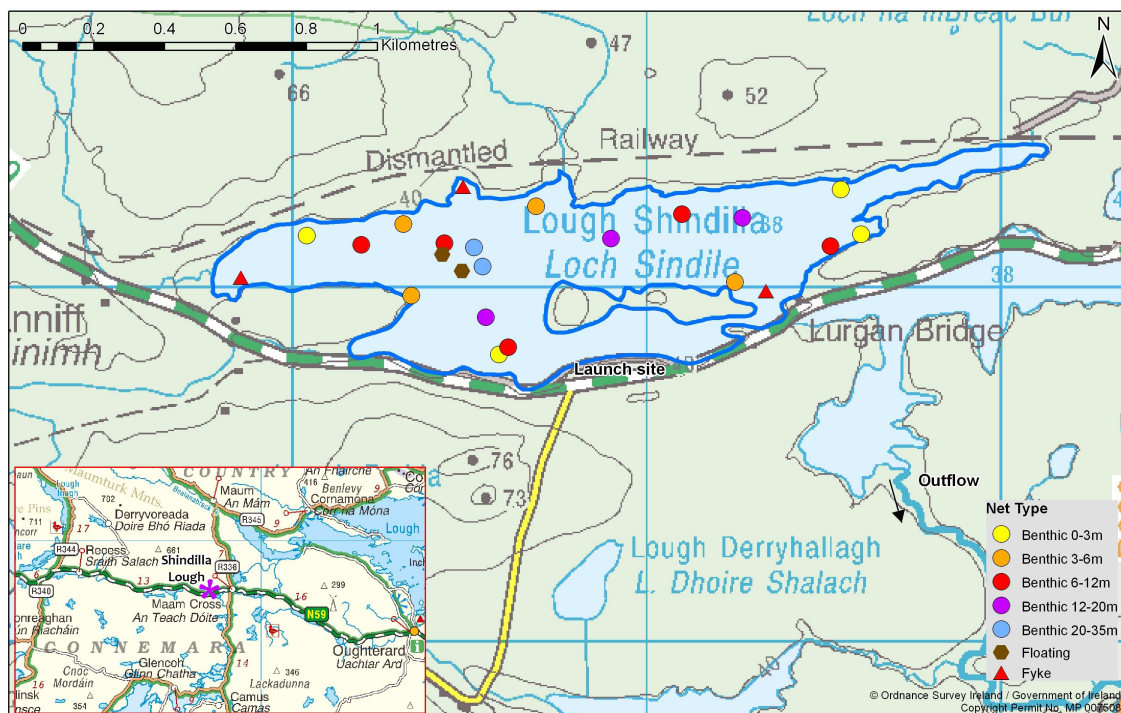


Fig. 1.1. Location map of Lough Shindilla showing net locations and depths of each net (outflow is indicated on map)

1.2 Methods

Lough Shindilla was surveyed over two nights from the 6th to the 8th of September 2010. A total of three sets of Dutch fyke nets, 18 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size)

CEN standard survey gill nets (4 @ 0-2.9m, 4 @ 3-5.9m, 5 @ 6-11.9m, 3 @ 12-19.9m and 2 @ 20-34.9m) and two floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (23 sites). Nets were deployed in the same locations as were randomly selected in the previous survey. A handheld GPS was used to mark the precise location of each net. The angle of each gill net in relation to the shoreline was randomised.

All fish apart from perch were measured and weighed on site and scales were removed from all Arctic char and brown trout. Live fish were returned to the water whenever possible (i.e. when the likelihood of their survival was considered to be good). Samples of fish were retained for further analysis.

1.3 Results

1.3.1 Species Richness

A total of five fish species were recorded in Lough Shindilla in September 2010, with 121 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Arctic char was the most abundant fish species recorded, followed by brown trout, perch and eels.

Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Shindilla, September 2010

Scientific name	Common name	Number of fish captured			Total
		Benthic mono multimesh gill nets	Surface mono multimesh gill nets	Fyke nets	
<i>Salvelinus alpinus</i>	Arctic char	53	0	0	53
<i>Salmo trutta</i>	Brown trout	21	2	0	23
<i>Perca fluviatilis</i>	Perch	22	0	0	22
<i>Anguilla anguilla</i>	European eel	0	0	22	22
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0	0	1	1

1.3.2 Fish abundance

Fish abundance (mean CPUE) and biomass (mean BPUE) were calculated as the mean number/weight of fish caught per metre of net. For all fish species except eel, CPUE/BPUE is based on all nets, whereas eel CPUE/BPUE is based on fyke nets only. Mean CPUE and BPUE for all fish species are summarised in Table 1.2. Mean CPUE is illustrated in Figure 1.2.

Although the mean Arctic char and brown trout CPUE were slightly lower in 2010 than in 2007, this difference was not statistically significant. The differences in the mean Arctic char CPUE between Lough Shindilla and three other similar lakes were assessed and found to be statistically significant

(Kruskal-Wallis, $P < 0.05$) (Fig. 1.3). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Shindilla had a significantly higher mean Arctic char CPUE than Ardderry Lough ($z = -2.876$, $P < 0.05$).

The differences in the mean brown trout CPUE between Lough Shindilla and three other similar lakes were assessed and also found to be statistically significant (Kruskal-Wallis, $P < 0.001$) (Fig. 1.4). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Shindilla had a significantly lower mean brown trout CPUE than Maumwee Lough ($z = -4.254$, $P < 0.001$).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured in Lough Shindilla, 2007 and 2010

Scientific name	Common name	2007	2010
Mean CPUE			
<i>Salmo trutta</i>	Brown trout	0.046 (0.012)	0.033 (0.015)
<i>Salvelinus alpinus</i>	Arctic char	0.091 (0.028)	0.077 (0.305)
<i>Salmo salar</i>	Salmon	0.001 (0.001)	-
<i>Phoxinus phoxinus</i>	Minnnow	0.010 (0.006)	-
<i>Perca fluviatilis</i>	Perch	-	0.032 (0.013)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	0.001 (0.001)
<i>Anguilla anguilla</i>	European eel	0.066 (0.058)	0.122 (0.475)
Mean BPUE			
<i>Salmo trutta</i>	Brown trout	3.811 (1.035)	1.539 (0.697)
<i>Salvelinus alpinus</i>	Arctic char	7.716 (2.482)	5.104 (2.131)
<i>Salmo salar</i>	Salmon	5.797 (5.797)	-
<i>Phoxinus phoxinus</i>	Minnnow	0.043 (0.030)	-
<i>Perca fluviatilis</i>	Perch	-	6.907 (3.434)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	0.0004 (0.0004)
<i>Anguilla anguilla</i>	European eel	9.027 (8.745)	16.183 (5.836)

* On the rare occasion where biomass data was unavailable for an individual fish, this was determined from a length/weight regression for that species.

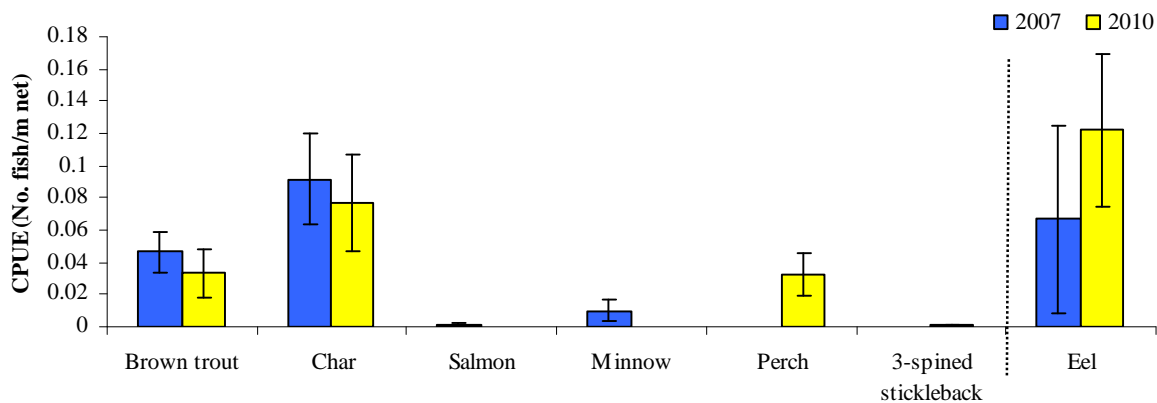


Fig. 1.2. Mean (\pm S.E.) CPUE for all fish species captured in Lough Shindilla (Eel CPUE based on fyke nets only), 2007 and 2010

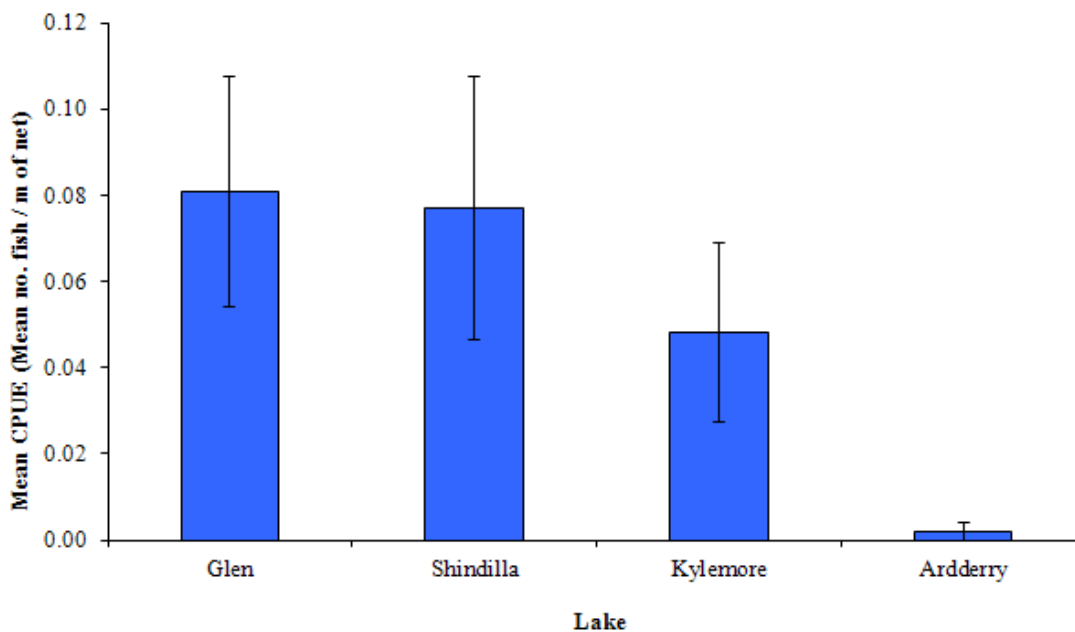


Fig. 1.3. Mean (\pm S.E.) Arctic char CPUE in four lakes surveyed during 2010

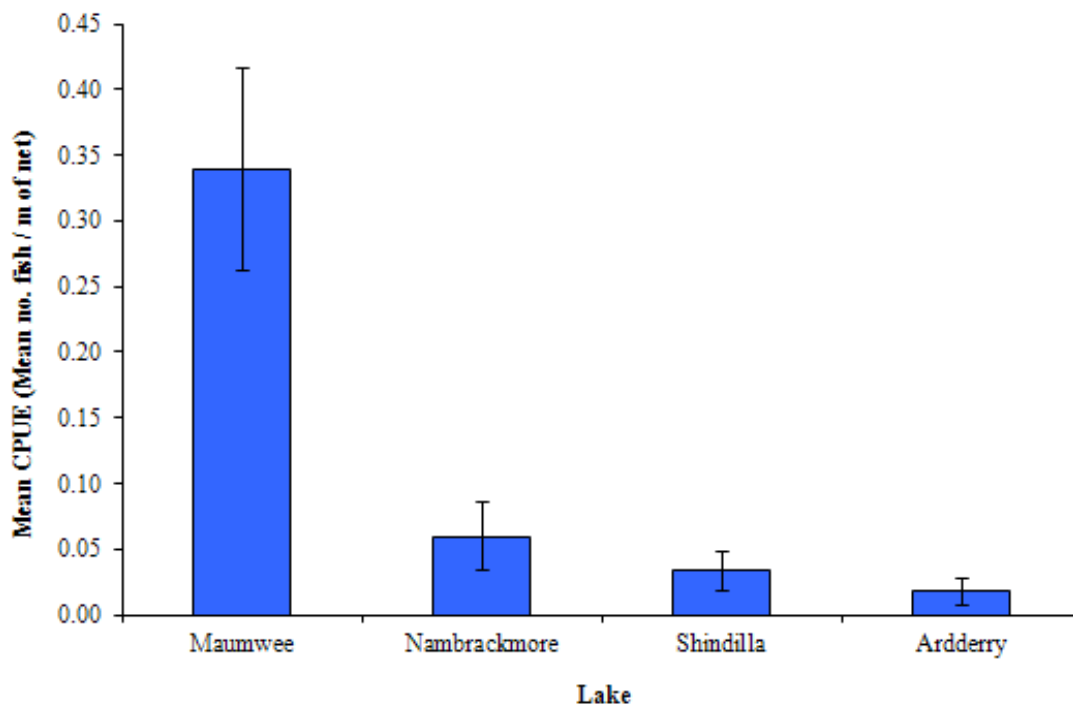


Fig. 1.4. Mean (\pm S.E.) brown trout CPUE in four lakes surveyed during 2010

1.3.3 Length frequency distributions

Arctic char captured during the 2010 survey ranged in length from 12.5cm to 20.9cm (mean = 18.1cm) (Fig. 1.5). Arctic char captured during the 2007 ranged in length from 7.0cm to 23.0cm (Fig. 1.5).

Brown trout captured during the 2010 survey ranged in length from 9.0cm to 23.2cm (mean = 15.1cm) (Fig. 1.6). Brown trout captured during the 2007 survey ranged in length from 12.6cm to 32.3cm (Fig.1.6).

Perch captured during the 2010 survey ranged in length from 10.0cm to 29.6cm and eels ranged in length from 32.2cm to 50.0cm.

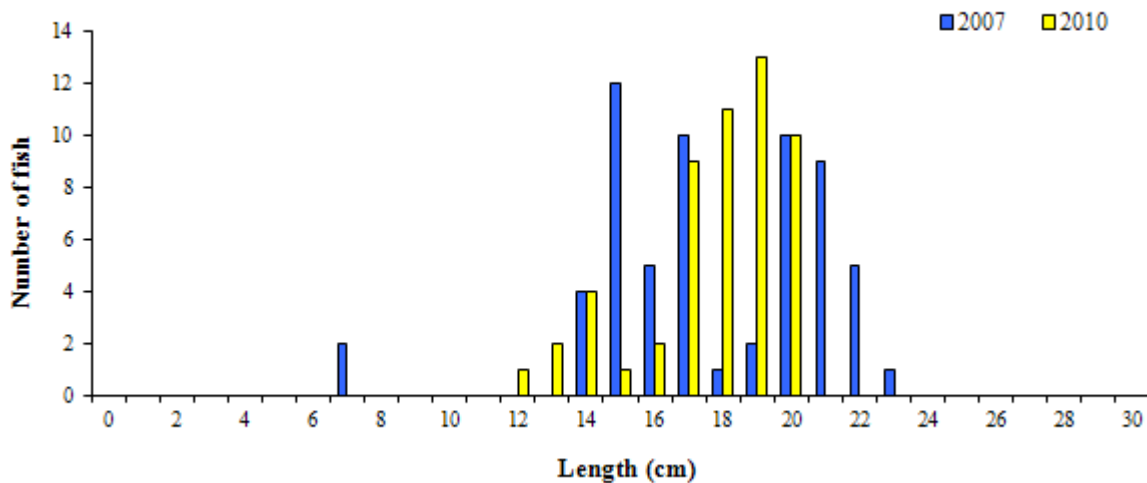


Fig. 1.5. Length frequency of Arctic char captured on Lough Shindilla, 2007 and 2010

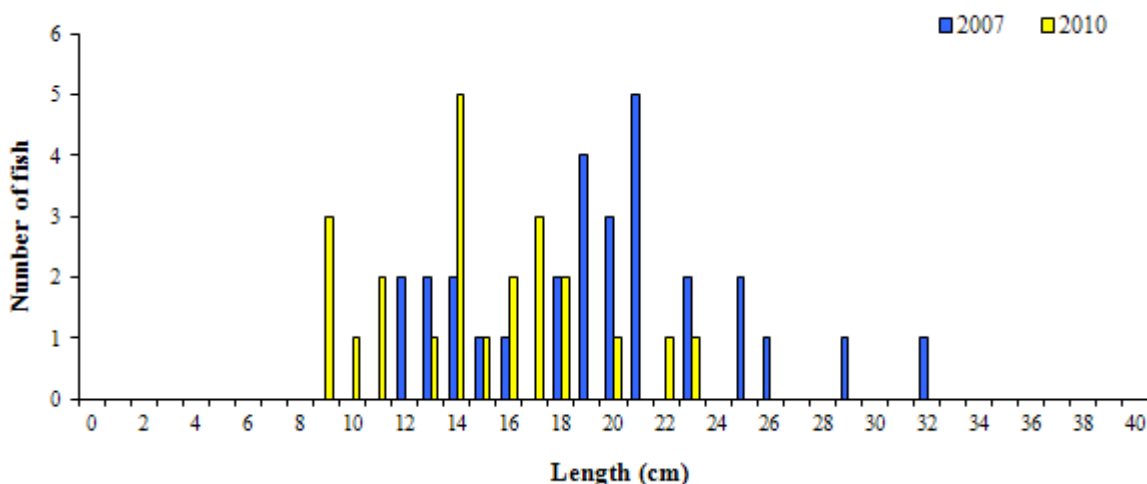


Fig. 1.6. Length frequency of brown trout captured on Lough Shindilla, 2007 and 2010

1.3.4 Fish age and growth

Four age classes of brown trout were present, ranging from 1+ to 4+, with a mean L1 of 5.7cm (Table 1.3). In the 2007 survey, brown trout ranged from 1+ to 3+ with a mean L1 of 5.9cm. Mean brown trout L4 was 20.3cm (Table 1.3) indicating a very slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971).

Five age classes of perch were present, ranging from 1+ to 6+, with a mean L1 of 6.9cm (Table 1.4).

Five age classes of Arctic char were present, ranging from 1+ to 5+. In the 2007 survey, Arctic char ranged from 2+ to 5+.

Table 1.3. Mean (\pm SE) brown trout length (cm) at age for Lough Shindilla, September 2010

	L ₁	L ₂	L ₃	L ₄
Mean	5.7 (0.3)	12.9 (0.8)	17.6 (1.2)	20.3
N	22	9	3	1
Range	4.0-8.8	10.2-16.7	16.2-19.9	20.3-20.3

Table 1.4. Mean (\pm SE) perch length (cm) at age for Lough Shindilla, September 2010

	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆
Mean	6.9 (0.3)	14.9 (0.7)	21.4 (0.4)	24.1 (0.9)	27.0 (0.1)	27.6
N	22	19	5	5	2	1
Range	3.1-9.6	6.6-18.7	20.0-22.5	21.0-25.8	26.9-27.0	27.6-27.6

1.4 Summary

Arctic char was the dominant species in terms of abundance (CPUE) and perch were the dominant species in terms of biomass (BPUE).

The mean Arctic char CPUE in Lough Shindilla was slightly lower in 2010 than 2007 however this difference was not statistically significant. The mean Arctic char CPUE from the lake was significantly higher than Ardderry Lough but was comparable to Kylemore Lough and Glen Lough. Arctic char ranged in age from 1+ to 5+, indicating reproductive success in five of the previous six years. However, no 0+ fish were recorded.

The mean brown trout CPUE in Lough Shindilla was also slightly lower in 2010 than 2007, however this difference was not statistically significant. The mean brown trout CPUE from the lake was significantly lower than Maumwee Lough but was comparable to Lough Nambrackmore and Ardderry Lough. Brown trout ranged in age from 1+ to 4+, indicating reproductive success in four of the previous five years. Length at age analyses revealed that brown trout in the lake exhibit a very slow rate of growth according to the classification scheme of Kennedy and Fitzmaurice.

Perch were recorded in Lough Shindilla for the first time, likely colonising the lake from Ardderry Lough during the floods in 2008 and 2009. The introduction of this non-native species has the potential to negatively impact the native brown trout and Arctic char populations. On-going monitoring will be needed to assess these impacts fully.

Classification and assigning lakes with an ecological status is a critical part of the WFD monitoring programme. It allows River Basin District managers to identify and prioritise lakes that currently fall

short of the minimum “Good Ecological Status” that is required by 2015 if Ireland is not to incur penalties.

A multimetric fish ecological classification tool (Fish in Lakes – ‘FIL’) was developed for the island of Ireland (Ecoregion 17) using IFI and Agri-Food and Biosciences Institute Northern Ireland (AFBINI) data generated during the NSSHARE Fish in Lakes project (Kelly *et al.*, 2008). This tool was further developed during 2010 (FIL2) in order to make it fully WFD compliant, including producing EQR values for each lake and associated confidence in classification. Using the FIL2 classification tool, Lough Shindilla has been assigned an ecological status of High for both 2007 and 2010 based on the fish populations present.

In the 2007 to 2009 surveillance monitoring reporting period, the EPA assigned Lough Shindilla an overall ecological status of Good, based on all monitored physico-chemical and biological elements, including fish. This status classification will be revised at the end of 2012.

1.5 References

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