National Research Survey Programme
Lakes 2016

Glen Lough

IFI/2017/1-4348

Iascach Intíre Éireann
Inland Fisheries Ireland

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**Fish Stock Survey of Glen Lough,
August 2016**

Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

ACKNOWLEDGEMENTS

1.1 Introduction

Glen Lough is located in the Lackagh catchment, approximately 5km east of Creeslough, Co. Donegal, with Glen village at the northern end of the lake (Plate 1.1, Fig. 1.1). The lake is located approximately 1.5km upstream of the tidal limit of the Lackagh River and approximately 7km downstream of Lough Beagh (Glenveagh) on the Owencarrow River. The lake is situated at an altitude of 27m a.s.l., has a surface area of 168ha, a mean depth of 4.9m and a maximum depth of 21m. Glen Lough 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 $CaCO_3$). The lake has been classed as 1a (i.e. at risk of failing to meet good status by 2015) in the WFD Characterisation report (EPA, 2005). The geology of the area is predominantly granite, felsite and other intrusive rocks rich in silica.

Glen Lough is encompassed within the Cloghernagore Bog and Glenveagh National Park Special Area of Conservation (SAC). The site supports populations of Atlantic salmon and freshwater pearl-mussel (*Margaritifera margaritifera*); species that are both afforded protected status in Ireland and listed on Annex II of the EU Habitats Directive (NPWS, 2005). Several bird species listed on the Red Data Book and on Annex I of the EU Birds Directive breed within the SAC. Turf cutting and afforestation are the main threats to the SAC, with erosion, over-grazing by sheep and deer and burning also having an impact (NPWS, 2005).

Glen Lough used to be one of the great spring salmon lakes; however, it never really recovered from the effects of the salmon disease UDN (Ulcerative Dermal Necrosis) in the 1960s (O' Reilly, 2007). In 1970 an Inland Fisheries Trust survey revealed the presence of brown trout only in the lake (IFT, unpublished data). A conclusion of the survey was that there was limited spawning in the upper reaches of the tributaries and impassable waterfalls restricting spawning to the lower reaches of the system. The lake is now best known as a sea trout fishery, even though numbers have declined (O' Reilly, 2007).

Glen Lough was previously surveyed in 2006, 2010 and 2013 as part of the NSSHARE Fish in Lakes Project and the WFD monitoring programme respectively (Kelly *et al.*, 2007 and Kelly *et al.*, 2011 and 2014). During the 2013 and 2010 surveys, brown trout were found to be the dominant species present in the lake. Arctic char, sea trout, eels, minnow and salmon were also captured.
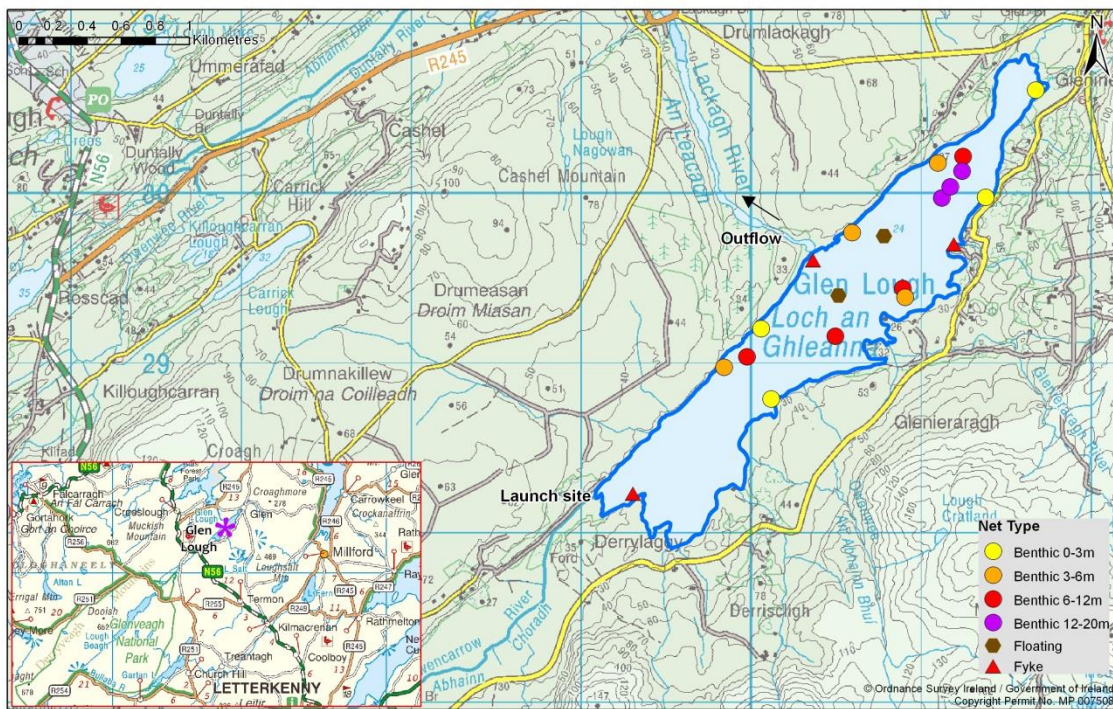
Plate 1.1. Glen Lough

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

1.2 Methods

1.2.1 Netting methods

Glen Lough was surveyed over two nights from the 8th to the 10th of August 2016. A total of three sets of Dutch fyke nets, 15 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (BM CEN) (4 @ 0-2.9m, 4 @ 3-5.9m, 4 @ 6-11.9m and 3 @ 12-19.9m) and two floating monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (20 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 were measured and weighed on site and scales were removed from all brown trout, sea trout, Arctic char and salmon. 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.

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1.2.2 Fish diet

Fish were frozen before being dissected for stomach content analysis in the IFI laboratory. Total stomach contents were inspected and individual items were counted and identified to the lowest taxonomic level possible. The percentage frequency occurrence (%O) of prey items were then calculated to identify key prey items (Amundsen *et al.*, 1996).

$$\%O_i = (N_i/ N)\times100$$

Where:

$\%O_i$ is the percentage frequency of prey item i,

N_i is the number of a particular species with prey i in their stomach,

N is total number of a particular species with stomach contents.

1.2.3 Biosecurity - disinfection and decontamination procedures

Procedures are required for disinfection of equipment in order to prevent dispersal of alien species and other organisms to uninfected waters. A standard operating procedure was compiled by Inland Fisheries Ireland for this purpose (Caffrey, 2010) and is followed by staff in IFI when moving between water bodies.

1.3 Results

1.3.1 Species Richness

A total of five fish species (sea trout are included as a separate 'variety' of trout) were recorded on Glen Lough in August 2016, with 168 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Brown trout was the most common fish species recorded. Arctic char, minnow, salmon, eels and sea trout were also recorded. During the previous surveys in 2006, 2010 and 2013 the same species composition was recorded except for sea trout which were not recorded in 2010 (Kelly and Connor, 2007 and Kelly *et al*., 2011 and 2014).

Table 1.1. Number of each fish species captured by each gear type during the survey on Glen Lough, August 2016

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
Salmo trutta	Brown trout	89	8	3	100
	Sea trout	1	1	0	2
Salvelinus alpinus	Arctic char	36	4	0	40
Phoxinus phoxinus	Minnow	13	0	0	13
Salmo salar	Salmon	3	0	0	3
Anguilla anguilla	European eel	0	0	10	10

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 captured in the 2006, 2010, 2013 and 2016 surveys are summarised in Table 1.2. Mean CPUE and BPUE for all species is illustrated in Figure 1.2 and 1.3.

Brown trout

Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE). Although the mean brown trout CPUE and BPUE fluctuated slightly over the four sampling occasions, these differences were not statistically significant (Table 1.2; Fig 1.2 and 1.3).

Arctic char

The mean Arctic char CPUE and BPUE decreased slightly over the four sampling years; however these differences were not statistically significant (Table 1.2; Fig 1.2 and 1.3).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Glen Lough, 2006 to 2016

Scientific name	Common name	2006	2010	2013	2016
		Mean CPUE			
Salmo trutta	Brown trout	0.165 (0.288)	0.137 (0.033)	0.216 (0.053)	0.164 (0.042)
	Sea trout	0.017 (0.006)	-	0.002 (0.002)	0.003 (0.002)
Salvelinus alpinus	Arctic char	0.173 (0.078)	0.081 (0.027)	0.073 (0.023)	0.067 (0.015)
Phoxinus phoxinus	Minnow	0.010 (0.006)	0.007 (0.004)	0.043 (0.023)	0.022 (0.011)
Salmo salar	Salmon	0.016 (0.006)	0.002 (0.002)	0.022 (0.011)	0.005 (0.003)
Anguilla anguilla	European eel	0.189 (0.049)	0.108 (0.058)	0.083 (0.019)	0.056 (0.015)
		Mean BPUE			
Salmo trutta	Brown trout	19.519 (4.372)	19.451 (6.020)	24.819 (6.069)	21.861 (5.754)
	Sea trout	3.122 (1.322)	-	0.307 (0.307)	1.041 (0.717)
Salvelinus alpinus	Arctic char	8.221 (4.248)	3.802 (1.334)	3.453(1.057)	2.491 (0.545)
Phoxinus phoxinus	Minnow	0.017 (0.017)	0.019 (0.011)	0.113 (0.055)	0.069 (0.044)
Salmo salar	Salmon	10.053 (9.997)	0.013 (0.013)	0.321 (0.168)	0.384 (0.323)
Anguilla anguilla	European eel	35.887 (10.953)	30.383 (16.950)	14.317 (5.464)	8.418 (1.292)

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

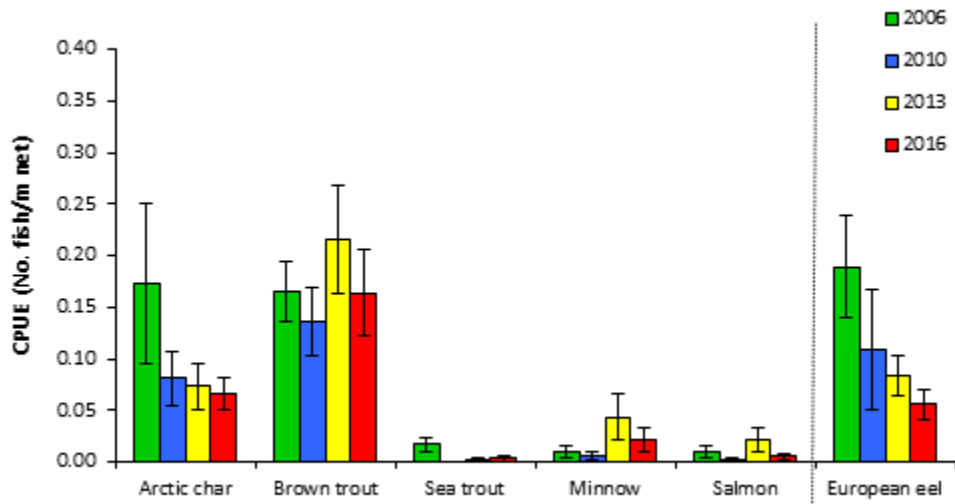*Eel CPUE and BPUE based on fyke nets only

Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Glen Lough (Eel CPUE based on fyke nets only), 2006, 2010, 2013 and 2016
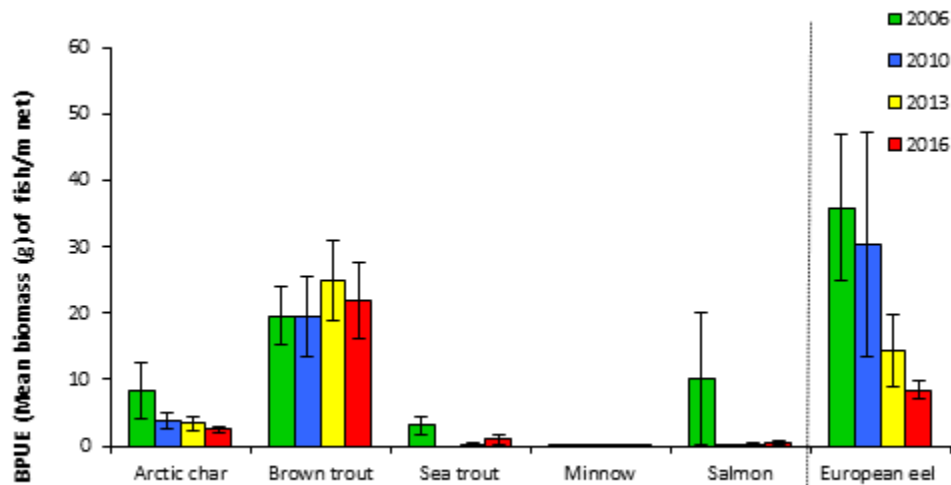

Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Glen Lough (Eel BPUE based on fyke nets only), 2006, 2010, 2013 and 2016

1.3.3 Length frequency distributions and growth

Brown trout

Brown trout captured during the 2016 survey ranged in length from 10.5cm to 45.0cm (mean = 21.7cm) (Fig. 1.4). Five age classes were present, ranging from 1+ to 5+, with a mean L1 of 6.2cm (Table 1.3). The dominant age class was 3+ (Fig. 1.4). Mean brown trout L4 in 2016 was 26.7cm indicating a slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971) (Table 1.3). Brown trout captured during the 2010 and 2013 surveys had similar length and age ranges, with some larger and older fish recorded in the 2010 and 2016 surveys (Fig.1.4).
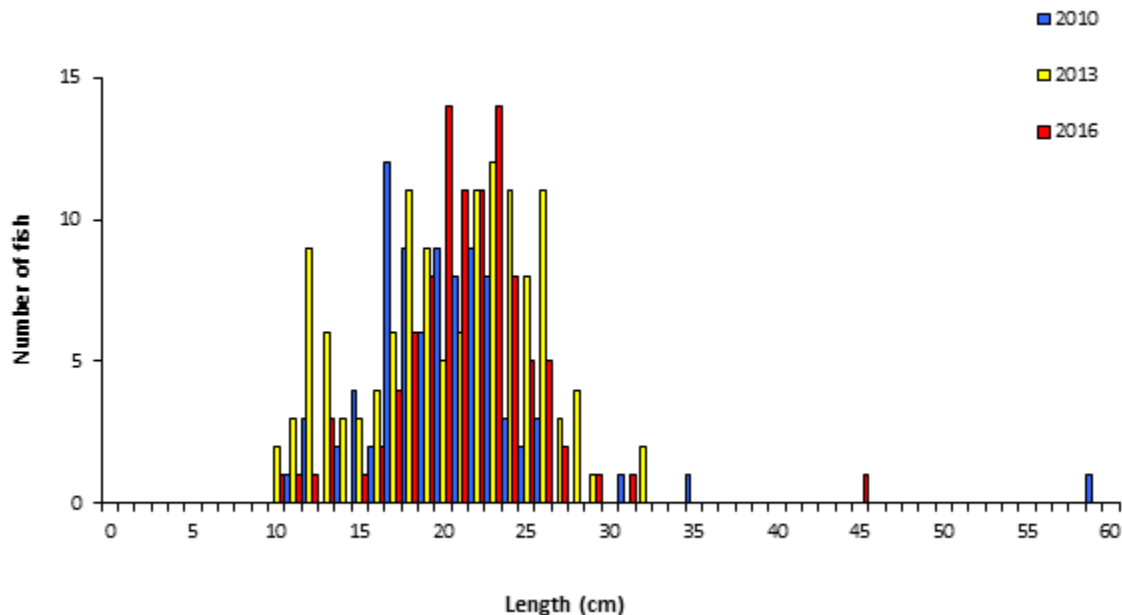

Fig. 1.4. Length frequency of brown trout captured on Glen Lough, 2010, 2013 and 2016

Table 1.3. Mean (±S.E.) brown trout length (cm) at age for Glen Lough, August 2016

	L_1	L_2	L_3	L_4	L_5	Growth Category
Mean (±S.E.)	6.2 (0.2)	14.7 (0.4)	21.2 (0.5)	26.7 (1.7)	39.4	Slow
N	43	35	19	5	1	
Range	4.1-9.0	10.0-19.2	14.9-23.8	20.8-30.6	39.4-39.4	

Arctic char

Arctic char captured during the 2016 survey ranged in length from 5.4cm to 18.5cm (mean = 13.8cm) (Fig.1.5) with six age classes present, ranging from 0+ to 5+. Arctic char captured during the 2010 and 2013 surveys had a similar length and age range (Fig.1.5).
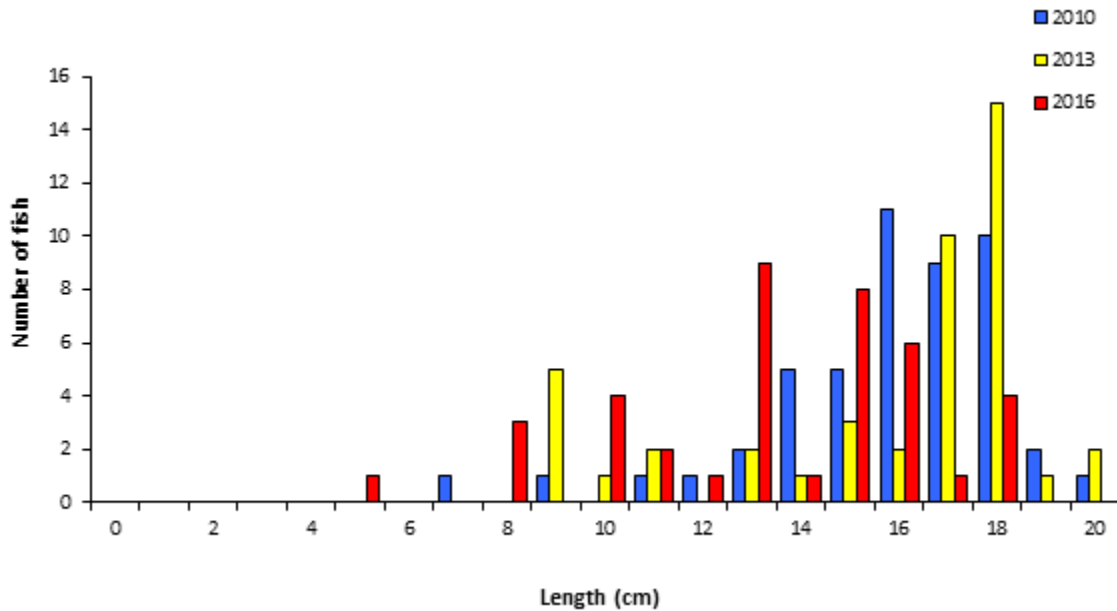

Fig. 1.5. Length frequency of Arctic char captured on Glen Lough, 2010, 2013 and 2016

Other fish species

Eels captured during the 2016 survey ranged in length from 36.9cm to 53.0cm. Three salmon captured were aged 1+ and 2.1+ and measured 10.1cm to 59.0cm. Sea trout ranged in length from 29.0cm to 30.8cm and ages ranged from 2.0+ to 2.1+. Minnow ranged in length from 5.1cm to 6.1cm.

1.3.4 Stomach and diet analysis

Dietary analysis studies provide a good indication of the availability of food items and the angling methods that are likely to be successful. However, the value of stomach content analysis is limited unless undertaken over a long period as diet may change on a daily basis depending on the availability of food items. The stomach contents of a subsample of brown trout captured during the survey were examined and are presented below.

Brown trout

Adult trout usually feed principally on crustaceans (*Asellus* sp*.* and *Gammarus* sp.), insects (principally chironomid larvae and pupae) and molluscs (snails) (Kennedy and Fitzmaurice, 1971, O'Grady, 1981). A total of 47 stomachs were examined. Of these 25 were found to contain no prey items. Of the 22 stomachs examined and containing food, 50% contained invertebrates and 50% unidentified digested material (Fig 1.6).
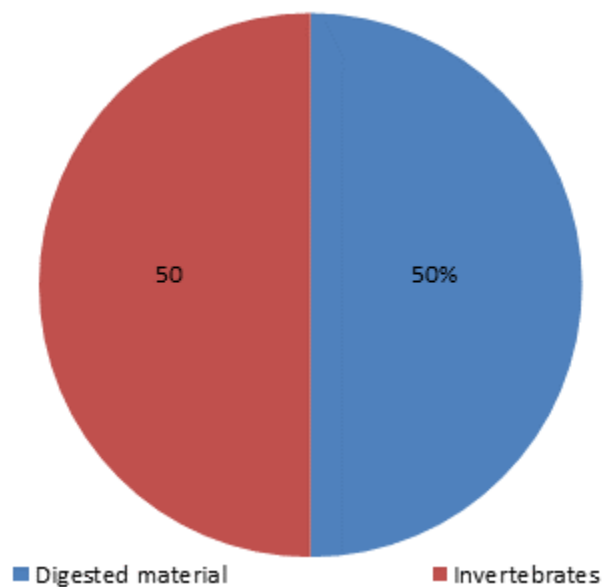

Fig 1.6. Diet of brown trout (n=22) captured on Glen Lough, 2016 (% occurrence)

1.4 Summary and ecological status

A total of five fish species (sea trout are included as a separate 'variety' of trout) were recorded on Glen Lough in the August 2016 survey. Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets.

Although the mean brown trout CPUE and BPUE fluctuated slightly over the four sampling occasions, these differences were not statistically significant. Brown trout ranged in age from 1+ to 5+, indicating reproductive success in five of the previous six years. The dominant age class was 3+. Length at age analyses revealed that brown trout in the lake exhibit a slow rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971). Invertebrates were the main food item in stomachs of brown trout captured during the survey.

The mean Arctic char CPUE and BPUE decreased every year over the four sampling years; however these differences were not statistically significant. Arctic char ranged in age from 0+ to 5+, with five age classes present.

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 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 (Kelly *et al.*, 2012b). Using the FIL2 classification tool, Glen Lough has been assigned an ecological status of High for 2016 based on the fish populations present. The lake was also assigned High status in 2006, 2010 and 2013.

In the 2010 to 2015 surveillance monitoring reporting period, the EPA assigned Glen Lough an overall ecological status of Good.

1.5 References

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