Upper thermal threshold of *Lepidurus arcticus* (Branchiopoda, Notostraca) in lakes on the southern outreach of its distribution range

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The Arctic tadpole shrimp *Lepidurus arcticus* has a circumpolar distribution and the Scandes (Fennoscandian Mountains) marks its southernmost limit in Europe. Within this area, 391 natural and 88 regulated lakes with *L. arcticus* have been identified, of which 87% are above the treeline. The lakes hosting *L. arcticus* decrease in altitude from south to north, which results from its temperature preferences. The majority of the locations are at a lower lake air temperature than 11°C which is equivalent to a water temperature near 14°C. This is assumed to be near the upper thermal threshold for *L. arcticus*. In lakes that exceed this average summer water temperature (1 July – 15 September), sustainable populations seem to be rare. In warmer lakes, life cycle mismatches are assumed to explain the absence of *L. arcticus*, most likely by affecting the embryo and juvenile stages. The distribution appears to be dichotomous, with one large northern area north of 65°N and one separated southern "island". Only two locations of *L. arcticus* are known for the area between latitudes 62.88 and 64.39°N. In this part of the Scandes, the lakes are likely too warm to host *L. arcticus* as most of them are situated below 700 m a.s.l. This may also be the case in the northernmost region, north of 70°N, where only 11 populations are recorded. Most of the lakes in this area typically occurs below 400 m a.s.l. *L. arcticus* populations are sensitive to fish predation, and dense fish populations may be another stressor limiting its distribution. In contrast to water bodies in the High Arctic where *L. arcticus* only exists in shallow, fishless ponds, in the Scandes they co-exist with fish in 97% of the findings. Global warming has already modified the environment of the Scandes, and populations of *L. arcticus* are at threat in many of the small and shallow water bodies at low altitudes.

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INTRODUCTION

Climate change over broad temporal scales has affected the distribution and composition of the regional vegetation in many areas, and an increasing treeline has proved to be a good indicator of long-term climate change (Dahl & Nesje 1996). The treeline in the Fennoscandian Mountain Ridge (59 to 71°N), also known as the Scandes, was far above the present treeline in early-to mid-Holocene (7600–4500 BP). From reconstructions of the treeline, the temperature in that period may roughly have been 1.5–2°C higher than at present (1961–1990). The warm period in early-Holocene may be regarded as an early analogue for the increased precipitation and temperature that is projected towards the end of the century (Hanssen-Bauer *et al.* 2017).

Ecological sensitivity is high in mountain habitats, where many species live at the threshold of their tolerance and thus close to their geographical limit (Lindholm *et al.* 2015). *Lepidurus arcticus* (Pallas, 1793) is a cold adapted Branchiopod species (Figure 1) with a circumpolar distribution (Rogers 2001; Hessen *et al.* 2004; Lakka 2013). Protracted warm periods may be problematic for *L. arcticus* in

Figure 1. The Arctic tadpole shrimp *Lepidurus arcticus* is a large (~2-4 cm) cold-water adapted species which mainly occurs in lakes above the treeline in the Scandes. Photo: Hanna-Kaisa Lakka.

Scandes which marks the southernmost part of its distribution range in Europe (Sømme 1934; Økland & Økland 2003). This may result in a range retraction of the species, as has already been experienced by another Branchiopod species, the *Branchinecta palludosa* O.F.Müller, 1758 (Lindholm *et al.* 2012, 2015).

Branchiopoda without cladocerans are commonly known as the "large branchiopods" (Brendonck *et al.* 2008). The order Notostraca is composed of the family Triopsidae and includes two genera (*Triops* and *Lepidurus*) of "living fossils" which have undergone minimal gross morphological change since their divergence over 250 million years ago (Longhurst 1955). *Lepidurus arcticus* (Figure 1) is one of these large branchiopods. Evidence of this "living fossil" has been found in lake sediments. For example, remains have been found inside the skull of a mammoth that lived during the ice age approximately 39000 BP (Neretina *et al.* 2020).

All the crustacean groups inhabiting temporary water bodies have evolved means to survive periods of desiccation and freezing. The production of resistant or diapause eggs that can withstand such harsh conditions has enabled successful invasion and colonization of these habitats (Longhurst 1955). The dry eggs can remain viable for decades without re-hydration (Donald 1983; Belk 1988, cited in Brendonck *et al*. 2008; Hann & Lonsberry 1991). However, drying or freezing is not mandatory. In practically all Brachiopoda, it is common to have both dormant and subitaneous embryos (Hann & Lonsberry 1991).

Lepidurus arcticus has a univoltine life cycle emerging from the resting eggs at snow melt and fulfils its development during a short mountain summer, before they reproduce and cease (Sømme 1934). The development and growth from hatching to adults has proved to be highly dependent on water temperature (Qvenild *et al.* 2018).

Distribution of *L. arcticus* in the Scandes, occurs near sea-level in the northernmost region, and at progressively higher altitudes towards the south (Sømme 1934; Økland & Økland 2003). This distribution pattern has mainly been explained by their temperature preferences (Sømme 1934; Aass 1969; Økland & Økland 2003). However, colonization history, water quality and snow deposition may also limit its distribution (Lingdell & Engblom 2002; Qvenild & Hesthagen 2019).

The optimal temperature of *L. arcticus* is approximately 10°C (Lakka 2013). This is met in Arctic conditions only for short periods but may frequently be experienced in Scandes lakes. As an adult, *L. arcticus* tolerates temperatures from 1.8°C (Lakka 2013) up to 19°C (Arnold 1966), although water temperature may be higher for short duration exposures (Borgstrøm 2019). For the juvenile stages, the upper lethal limit appears to be lower than 15°C (Pasquali *et al.* 2019).

Temperature drives the biological processes needed for fulfilling a life cycle. This input has often been expressed in terms of cumulative thermal units as degree-days (Bottrell 1975), being equivalent with the average water temperature in a specific period. Although *L. arcticus* may tolerate a wide range of temperatures, the lower altitudinal limit of lakes hosting *L. arcticus* clearly indicate that the thermal input at some level may be too high. Our main intention in this study is to outline the distribution of *L. arcticus* throughout the Scandes and correlate it with local thermal conditions. This may give some indication of its *upper thermal threshold*. As *L. arcticus* mainly occur in lakes situated in the Alpine or sub-Arctic zones in the Scandes (Sømme 1934; Økland & Økland 2003), its distribution can also be related to the treeline which throughout the mountain ridge are limited by birch (*Betula pubescens*), roughly following the 10°C July isotherm (Odland 1996).

Acquisition of thermotolerance data for organisms is essential, not only to determine the role of temperature related to reproduction, growth and survival, but also to predict the consequences of global warming to vulnerable cold-water adapted species like *L. arcticus*. A changing climate affects the species-specific extinction risk for *L. arcticus* (Lakka 2020). Thus, global warming imposes thermal risks that need to be studied from a species perspective in their natural habitats.

METHODS AND MATERIAL

The Scandes run through the Scandinavian Peninsula. To the north, they form the border between Norway and Sweden, just touching the north-western part of Finland. The fact that the central mountain ridge borders the coastline of Norway, makes the rivers draining to the west and north into the North Atlantic Ocean short, steep and violent, in comparison to the long and gentle rivers draining to the east and south into the distant Baltic Sea (Hammar 2002). The mountain range has a length of ca 1700 km, measured from Stavanger to the Varanger Peninsula in the north (59–70°N), and a width of ca 320 km at its broadest span between Kristiansund and Hamar (8–11°E). Its vast high plateaus and huge mountain massifs with alpine relief are deeply gouged by glaciers and numerous rivers draining in all cardinal directions. The mountain range creates a rain shadow of which the eastern part is considerably drier than the western part. In the area where the Arctic tadpole shrimp *L. arcticus*, occur, the yearly precipitation varies from more than 2800 mm on the western side of the mountains to less than 400 mm on the eastern fells. In most areas, the mountain range is situated above the treeline. The upper limit of birch (*Betula pubescens*) is some 150–200 m above the treeline for conifers (Dahl & Nesje 1996), also going farther north.

In this paper, we use the term "*Lepidurus* lake" as a lake of any size, hosting *L. arcticus* also including regulated lakes. However, analysing the thermal conditions met in *L. arcticus* populations we only use natural lakes as temperature conditions are highly impacted by the management regime in the regulated ones (see Aass 1969).

Winter precipitation is calculated for the period (1 October – 30 April) as a mean for the normal period (1961–1990) by the NEVINA procedure (NVE Atlas, nve.no) for most of the Norwegian lakes along the transect and interpolated to nearby locations for the rest. For the Swedish area which are located near the Norwegian border, we have used the values from the nearest Norwegian locality. For the

Finnish *Lepidurus* lakes we have used values from the meteorological station Kilpisjärvi Kyläkeskus for the period 1978–1989 (https://en.ilmatieteenlaitos.fi/). Finnish and Swedish *Lepidurus* lakes have in general low winter precipitation (<500 mm).

Mapping of the distribution

Most of the records are from stomach analyses of fish as this has proved to be far the most effective method to detect the presence of *L. arcticus*, especially when it appears in low numbers and/ or has a patchy distribution (Fjellheim *et al.* 2007; Qvenild & Hesthagen 2019). Other methods used to detect *L. arcticus* have included traditional methods as bottom samplers, plankton sieves and benthic littoral kick samples.

The Norwegian Biodiversity Information Centre (NBIC), offers a detailed, national coverage of *L. arcticus* (https://www.artsdatabanken.no). Most of these records were presented in Økland & Økland (2003). Similar records are available (https://bioatlas.se) from the Swedish Biodiversity Data Infrastructure (SBDI). For Finland we used information given by different authors (Koli 1957; Järvinen *et al.* 2014; Lakka *et al.* 2019; Lakka 2020). We have updated these datasets processing a vast amount of scientific and pertinent literature in addition to own observations. All the records are given in Appendix 1.

Air and water temperatures in the Scandes

The *normal period* refers to the standard reference period (1961–1990) set by the World Meteorological Organization (WMO). Such data is delivered by the Norwegian and Finnish national net of meteorological stations (https://met.no/; https://ilmatieteenlaitos.fi/). Daily air temperatures were obtained from the same stations. We have used data from eight meteorological stations throughout the Scandes (Table 1, Figure 2) situated 72 to 973 m a.s.l.

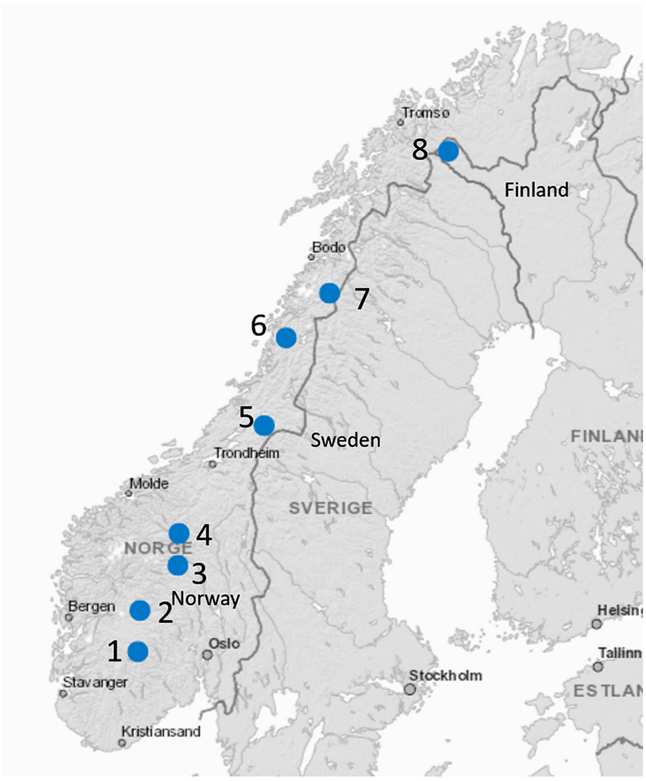

Figure 2. Location of the eight meteorological stations providing temperature data (1 Møsstrond; 2 Geilo-Olderbråten; 3 Skåbu; 4 Fokstugu; 5 Snåsa; 6 Mosjøen lufthavn; 7 Saltfjellet; 8 Kilpisjärvi Kyläkeskus). Norwegian Mapping Authority CC BY 4.0.

Table 1. Vital statistics of the eight meteorological stations used. Air temperature normal (1961-1990) are given for the summer period 1 July – 15 September and for July only. The air temperatures experienced at the stations in 2000-2019 are compared with the normal. The altitude of the isotherms of 8 and 10°C are estimated from the air temperature at the meteorological station using a lapse rate of 0.6°C 100 m^{-1}. Altitude for the treeline is computed from y (altitude) = 60.526*X (latitude) + 4647 (cf. Figure 4). Isotherms for the treeline are computed at the different stations for the period 1 July – 15 September and for July only.

Municipality	St. no.	Meteorological station	Latitude °N	Longitude °E	Altitude met. st. m a.s.l.	Normal 1961-1990 °C	Normal July 1961-1990 °C	Mean temp. 2000-2019 °C	Deviation from normal °C	Altitude treeline m a.s.l.	Isotherm at treeline (1 Jul-15 Sep) °C	Isotherm at treeline (July) °C
Vinje	31620	Møsstrond	59.8397	8.1785	977	9.37	10.50	10.50	1.13	1 026	9.08	10.21
Hol	25630	Geilo-Olderbråten	60.5300	8.1948	772	9.94	11.19	11.38	1.44	984		9.92
Nord-Fron	13670	Skåbu	61.5152	9.3823	890	9.64	11.00	10.44	0.80	924	9.44	10.80
Dovre	16600	Fokstugu	62.1133	9.2862	973	8.66	10.00	9.97	1.31	888	9.17	10.51
Snåsa	70850	Snåsa	64.1587	12.4692	195	11.78	12.90	13.30	1.52	764	8.37	9.49
Vefsn	77230	Mosjøen lufthavn	65.7842	13.2180	72	11.92	13.00			666	8.36	9.44
Saltdal	81800	Saltfjellet	66.5700	15.3413	685	8.52	9.70			618	8.92	10.10
Enontekiö	9003	Kilpisjärvi Kyläkeskus	69.0495	20.7912	480	9.06	10.58	10.46	1.40	468	9.13	10.65

Table 2. Water temperature profiles from 32 Norwegian lakes in the southern part of the Scandes for the summer period 1 July – 15 September. Winter precipitation is calculated with the NEVINA procedure (nve.no). Data from Lake Øvre Heimdalsvatn are from the long-term interdisciplinary project described in Brittain et al. (2010). The data are available from the database Hydra II (nve.no). Details are given in Appendix 2.

ID no.	Lake	Municipality	Latitude °N	Longitude °E	Altitude m a.s.l.	Area km²	Mean depth m	Max. depth m	Catchment km²	Winter prec. mm	N	Water temp. °C	±SD	Range	Period
393	Dragøyfjorden	Eidfjord	60.4684	7.6874	1180	3.33	10.0	42.0	35.5	487	14	9.52	1.8	5.17-12.23	2004-2013, 2015-2018
420	Nordmannslågen	Eidfjord	60.1897	7.4504	1244	10.88	4.2	16.0	116.8	547	1	12.87			2018
1906	Isdalsvatnet	Eidfjord	60.4487	7.2911	832	1.07	5.3	20.8	49.6	726	1	14.57			2019
1910	Langavatn	Eidfjord	60.2565	7.5180	1222	2.65		10-15	86.6	542	1	10.88			2016
17018	Svartevasstjørni	Eidfjord	60.5095	7.6949	1243	0.40	4.8	18.0	7.6	498	15	9.94	1.8	6.07-12.96	2003-2013, 2015-2018
27430	Tinnhølen	Eidfjord	60.2683	7.6006	1213	4.54	~3	7.0	127.6	528	1	11.10			2016
389	Skurdalsvatnet	Hol	60.4712	8.2868	782	2.08	7.0	27.0	109.4	314	2	14.86			2017-2018
390	Orsjoren	Hol	60.3766	8.2138	951	2.37		8.0	1 179.0	424	1	11.18			2017
17281	Holværvatn	Hol	60.4417	8.0883	1183	1.43	8.9	28.0	10.4	355	2	11.89			2017-2018
17371	Skjerjavatn	Hol	60.4199	7.9683	1192	1.57	1.7	6.0	9.7	369	3	12.23			2017-2019
395	Langesjøen	Nore og Uvdal	60.2452	7.7415	1210	11.04	4.0	16.0	130.3	441	1	11.87			2013
396	Geitvatnet	Nore og Uvdal	60.2010	7.8743	1197	1.55	2.8	11.8	362.4	496	2	11.32			2012-2013
109	Viuvatnet	Tinn	60.1443	7.9960	1324	3.03			14.9	345	1	12.35			2018
876	Forollsjøen	Tynset	62.6852	10.8166	992	3.78	5.9	18.0	15.9	596	1	12.95			2006
35279	Fjellsjøen	Tynset	62.6852	10.8986	973	0.57	2.5	11.0	5.2	577	1	13.30			2006
35414	Stor-Innsjøen	Tynset	62.5225	10.2360	821	0.79		6.0	8.8	186	7	13.41	0.8	12.22-14.49	2010-2014, 2016-2017
1904	Opesjovatnet	Ullensvang	60.2963	6.7509	1014	1.25	8.8	36.0	51.9	988	3	11.27			2016-2018
1912	Veivatnet	Ullensvang	60.2584	6.9082	1172	4.68	12.8	58.0	112.2	893	3	10.46			2016-2018
1913	Omkjelsvatnet Nedre	Ullensvang	60.2012	6.9595	1199	2.39			62.8	871	3	10.52			2016-2018
18034	Djupavatnet	Ullensvang	60.2044	7.0016	1291	0.14			4.5	840	1	12.36			2018
27637	Omkjelsvatnet Øvre	Ullensvang	60.1839	6.9435	1202	0.55			9.4	939	1	6.69			2016
12	Vollevatn	Vinje	60.0223	7.7223	1030	1.66	3.3	11.5	614.3	605	6	12.40	2.1		2006, 2013, 2015-2016, 2018-2019
13	Briskevatn	Vinje	60.0271	7.6286	1068	2.62	8.2	22.1	588.4	611	4	11.61			2006, 2015-2016, 2019

Table 2. Continued.

ID no.	Lake	Municipality	Latitude °N	Longitude °E	Altitude m a.s.l.	Area km²	Mean depth m	Max. depth m	Catchment km²	Winter prec. mm	N	Water temp. °C	±SD	Range	Period
14	Gunleiksbuvatn	Vinje	60.0296	7.5513	1071	1.29	1.6	7.2	434.6	652	3	11.93			2006, 2015, 2018
17	Sandvatn	Vinje	60.0558	7.4844	1112	1.57	2.6	13.0	288.2	696	14	11.53	1.5	8.29-14.06	2003-2011, 2013-2014, 2017-2019
39	Fjellsjåen	Vinje	60.0961	7.6260	1195	2.31	8.1	26.0	37.5	495	4	11.65			2006, 2010, 2012-2013
18770	Blånuttjørnane	Vinje	60.0914	7.5060	1310	0.31	6.1	31.0	3.7	512	1	10.78			2004
18827	Dargesjåen	Vinje	60.0788	7.5796	1205	0.64	4.7	15.0	15.7	500	16	11.95	1.4	10.12-13.74	2003-2019
18854	Kringlesjåen	Vinje	60.0739	7.6086	1255	0.72	4.5	14.0	3.2	493	1	11.15			2004
272	Øvre Heimdalsvatn	Øystre Slidre	61.4224	8.8675	1088	0.78	4.7	13.0	25.9	571	32	12.14	1.1	10.38-14.38	1985-2018
16246	Buhovdvatnet	Ål	60.7421	8.6751	977	0.28			11.0	284	4	13.71		13.09-15.01	2011, 2013, 2016, 2018
16334	Øknevatni	Ål	60.7186	8.6809	940	0.36			5.0	263	3	13.87		13.37-14.71	2012-2013, 2016

Continuous daily monitoring of water temperature data is available for only a limited number of lakes in the Scandes. Lake Øvre Heimdalsvatn has been surveyed since 1958 (Brittain & Borgstrøm 2010) and after 1985 water temperature has been measured (Hydra II, nve.no). In addition, we have used own observations from 31 Norwegian lakes in the southern part of the Scandes during the period 2003–2019. Most of the lakes are situated at the Hardangervidda mountain plateau (59.9–60.6°N, 6.9–8.4°E; 832–1386 m a.s.l.) which provides a wide range of different climatic conditions (see Qvenild & Hesthagen 2019). In total, water temperatures are available from 32 lakes, representing 153 average summer values (Table 2, Appendix 2). *Lepidurus arcticus* is recorded in 26 of the lakes (Appendix 2). The six lakes without *L. arcticus* were included to strengthen the correlation between lake air temperature and water temperature in mountain lakes.

In this context, the summer period was defined to be 1 July – 15 September as most of the temperature loggers have operated continuously in this period. The surface water temperature (subsequently referred to as *water temperature*) was obtained by temperature loggers (mainly the Hobo UA-002-64) which were placed in the littoral zone at 1–3 m depth. In a few lakes, temperature loggers were also placed in the profundal zone. Hence, water temperature and lake air temperature refer to an average for the period 1 July – 15 September.

The air temperature is lowered by a linear adiabatic lapse rate with increasing altitude. The lapse rate may vary with topography, regional and temporal climatic variables, variable altitudinal range and for temperature variability (Odland 1996). Laaksonen (1976) calculated a general lapse rate in Fennoscandia based on data from 612 meteorological stations. Regression between altitude and mean July temperature provided a lapse rate of 0.57°C 100 m^{-1} ($R^2 = 0.90$). Data from 40 meteorological stations in the Swiss Alps revealed quite constant lapse rates at about 0.6°C 100 m^{-1} during the summer (Livingstone *et al.* 1995). An approximate lapse rate of 0.6°C 100 m^{-1} is widely accepted for the summer season in Fennoscandia (Odland 1996; Dahl & Nesje 1996; Kvambekk & Melvold 2010) and hence, we assume this to be a good proxy to calculate air temperature at the specific lakes.

The air temperature at the meteorological stations were transformed to isotherms along the Scandes by using this lapse rate. Further, these data were used to estimate the air temperature (later noted as *lake air temperature*) at the 32 lakes represented with water temperature profiles. For the specific meteorological stations, the air temperature normal, using the average daily temperature (1 July – 15 September) for the period 1961–1990, are provided (Table 1). This was used to estimate the altitudes ($Alt_{10°C}$) where the air temperature is 10°C at the specific latitudes (Lat) of the meteorological stations. The 10°C isotherm is given by the regression line:

$$Alt_{10°C} = -64.229 * Lat + 4698.4 \quad (1)$$

From this regression ($R^2 = 0.91$), the lake air temperatures normal at the specific lakes were calculated. From the latitude of the lake, we calculated $Alt_{10°C}$ and adjusted this to the real altitude of the lake by using the lapse rate 0.6°C 100 m^{-1}.

To provide data from a lake where we could have expected *L. arcticus* but where it is not found, we included Lake Skurdalsvatnet (782 m a.s.l.) at the eastern fells of Hardangervidda (Table 2). In the early 1900s, the lake was thoroughly studied focusing on brown trout and its food organisms. The lake was surveyed at 21 occasions through seven years “without finding the least trace of the organism”, i.e.

L arcticus (Dahl 1917, 1926, 1932). In the upstream lakes, *L. arcticus* was the main food item for brown trout. This pattern was confirmed by new surveys in 1974 and 1975 (Amundsen 1976). We hypothesize Lake Skurdalsvatnet to be too warm for *L. arcticus* and thus, this particular lake may give an indication of the upper thermal threshold of the species. We used the meteorological station 25720 Haugastøl (996 m a.s.l.) 24 km northwest to the lake, to estimate the lake air temperature for summers before 1975.

Statistical methods

The non-linear relationship between lake air temperature and water temperature for 26 lakes with *Lepidurus* and 6 lakes without were modelled with cubic splines (lambda = 4), and 95% confidence bands for the curves were estimated from bootstrapped samples (random sampling with replacements, 1000 samples).

For five of the *Lepidurus* lakes we have numerous data on lake air and water temperatures (n: 14–39), which allowed us to give a closer statistical analysis of their relationship. Hence, we performed an analysis of covariance (ANCOVA) with water temperature as the response variable and lake air temperature (log-transformed), lake and their interactions as predictors.

The probability of the *Lepidurus* lakes to be situated above or beneath the tree line was modelled with a nominal logistic model with altitude and latitude as predictor variables.

We used the statistical program JMP (v. 15.2.0, SAS Institute Inc. 2019) for these analyses.

RESULTS

Geographic distribution of *Lepidurus arcticus* in the Scandes

Lepidurus arcticus has been recorded in 479 lakes in the Scandes mountains, covering latitudes 59.48–70.74°N and elevations 74–1524 m a.s.l. (Figure 3, Appendix 1). Norwegian locations, ranging both further south and north than those in Sweden and Finland, dominate the dataset. On the Norwegian mainland, 315 and 79 are natural and regulated lakes, respectively. On the Swedish side, 78 locations were recorded, of which eight are regulated. In Finland, *L. arcticus* was found in six lakes and one small pond of which one is regulated (Lake Inarijärvi). Although Lake Inarijärvi, is not considered part of the Scandes, it was included in this material.

The geographic distribution of natural lakes covers two major alpine areas; one vast northern area with 167 records north of 64.39°N, and the other in the south with 222 locations (59.48 to 62.87°N). The natural *Lepidurus* lakes recorded in the southernmost part of the Scandes were situated at altitudes from 489 to 1524 m a.s.l. Between 62.88 and 64.5°N, only two natural lakes with *L. arcticus* are known, both situated in Sweden. In this area, few mountains reach altitudes above 700 m a.s.l. In the northernmost part, north to 70°N, only 11 natural lakes where located, all at altitudes below 327 m a.s.l. In this area, the mountains are barely hills, few reaching more than 400 m a.s.l. (Figure 4). The altitudes of the natural lakes with *L. arcticus* thus decline towards the north. Information of lake depths are only known from 78 natural lakes (Appendix 1). The deepest lake has a maximum depth of 77 m. Of these limited numbers of lakes, 30% are shallower than 10 m and 60% are shallower than 20 m. Consequently, most of the lakes must be characterized as relatively deep lakes.

Most of the Swedish records of *L. arcticus* were found in northern river-systems known to contain numerous natural fish-free head-water lakes. All the natural Finnish *Lepidurus* lakes are from the north-

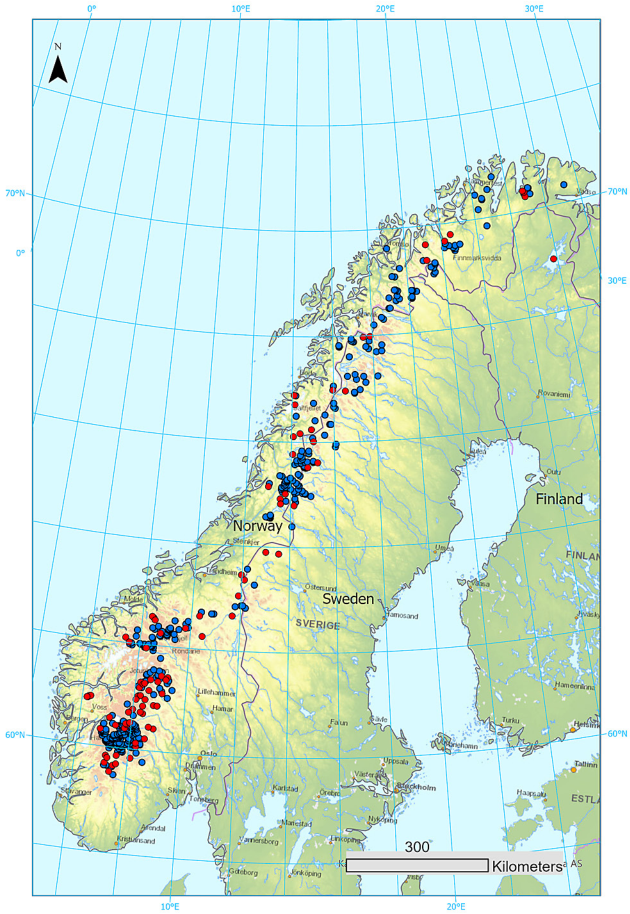

Figure 3. Distribution of 479 lakes hosting *Lepidurus arcticus* in the Scandes. Natural lakes (391) are indicated by blue dots and regulated lakes (88) with red dots. Norwegian Mapping Authority CC BY 4.0.

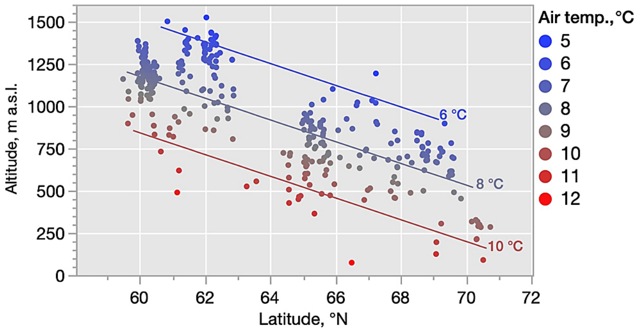

Figure 4. Contour plot of average summer (1 July - 15 September) lake air temperature, latitude and altitude for 391 lakes with *Lepidurus arcticus*. A central tendency in the lake distribution is that they are spread around the 8°C isotherm in the plot. Air temperatures are indicated by a continuous colour scale (blue - gray -red).

western part of Finnish Lapland in the municipality of Enontekiö. In addition, *L. arcticus* is known from the regulated Lake Inarijärvi in the municipality of Inari.

Diversity of fish in the *Lepidurus* lakes

As *L. arcticus* is an attractive prey for benthic fish, the diversity of fish species has been listed. Fish status is available from 379 of the 391 natural *Lepidurus* lakes. A total of ten fish species (Appendix 1) were documented (if a specific reference is not given in Appendix 1, we have used NIBC (Artsdatabanken) or own data). Given the fact that most records of *L. arcticus* originate from fish diet analysis, only a small number of ponds were considered free of fish (~3%). Most of the 379 natural lakes host brown trout (89%), with many being introduced. Arctic char is also frequently occurring (>23%), especially in the northern Scandes. The invasive Eurasian minnow *Phoxinus phoxinus* (L., 1758) has now spread to many of the *Lepidurus* lakes and have established in at least 9% of them. Grayling *Thymallus thymallus* (L., 1758), burbot *Lota lota* (L., 1758), perch *Perca fluviatilis* L., 1758, whitefish *Coregonus lavaretus* (L., 1758), ninespine stickleback *Pungitius pungitius* (L., 1758), northern pike *Esox lucius* L., 1758 and non-native American brook trout *Salvelinus fontinalis* (Mitchill, 1814) do also occur in some lakes. In addition, the regulated Lake Inarijärvi has three more species (salmon *Salmo salar* L. 1758, three-spine stickleback *Gasterosteus aculeatus* L. and non-native lake trout *Salvelinus namaycush* (Walbaum, 1792)) and contained in total thirteen fish species.

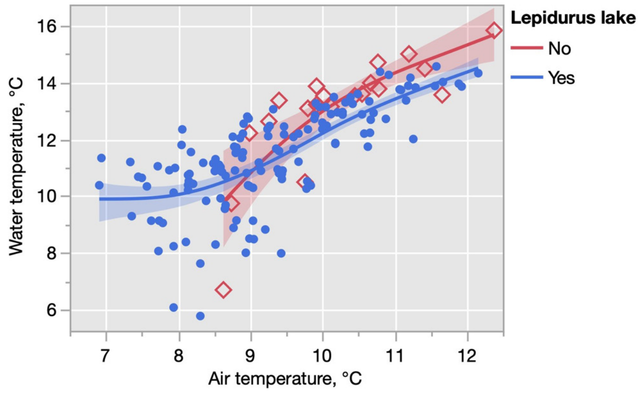

Figure 6. Relationship between average summer (1 July – 15 September) lake air temperature and water temperature in lakes with and without *Lepidurus arcticus*. Number of observations are as follows: for 26 *Lepidurus* lakes, n = 133; for 6 lakes without *Lepidurus arcticus*, n = 20. The curves are based on cubic splines with 95 % confidence bands.

Interrelationship of lake air temperature and water temperature

The frequency distribution of lake air temperature for the 391 *Lepidurus* lakes (Figure 5), shows an absolute range of about 5–12°C, and an interquartile range of 7.1–8.5°C, with mean and median values of 7.9 and 7.8°C, respectively. Recent (2000–2019) summer temperatures (1 July – 15 September) were 0.91–1.52°C higher compared to the reference period 1961–1990 (Table 1).

The 8°C isotherm decreased from 1205 to 657 m a.s.l. from south (Møsstrond 59.83°N) to north (Kilpisjärvi Kyläkeskus 69.05°N), respectively.

The relationship between lake air temperature and water temperature reveal a nonlinear regression (Figure 6). Tested against real lake air temperatures, the deviation to the estimated values were minor in our reference lakes (cf. Stor-Innsjøen. Dragøyfjorden, Veivatnet, Buhovdvatnet and Øknevatn in southern Norway, cf. Appendix 2). When the lake air temperature exceeded 10°C, the water temperature was 2–4°C higher than lake air temperature. In summers being warmer than 10°C, the water temperatures becomes near 14°C in the *Lepidurus* lakes and only seldomly higher. For mountain lakes without *L. arcticus*, the water temperature may be higher. In our data matrix the highest water temperature in summer was 15.8°C in Lake Skurdalsvatnet (no *L. arcticus*) in 2018.

The water temperature measurements of the 32 lakes (of which 26 had *L. arcticus*) revealed that most of the lakes with lake air temperature warmer than 10°C had water temperatures 3–4°C above lake air temperature, i.e. 13–14°C (cf. Figure 6). Further, at a lower lake air temperature of approximately 8°C, i.e. close to the median value of the 391 lakes in Figure 5, the corresponding water temperature for most of the lakes were within the range 8–12°C. A more thorough statistical analysis (ANCOVA) on a smaller subset of five *Lepidurus* lakes with numerous data on lake air and water temperatures confirmed the water temperature in general to be significantly elevated compared to the lake air temperature, and that the relationship between lake air temperature and water temperature (the regression coefficients) differed between lakes (cf. text in Figure 7). The adjusted means of water temperatures were in the range of 9.6–12.2°C at a lake air temperature of 9.2°C (geometric mean of the data). The graph of the regression curves for the individual lakes reveals a tendency for decreasing differences between water and lake air temperature at lower lake air temperatures for the coldest lakes (Figure 7).

In Lake Skurdalsvatnet where *L. arcticus* never has been recorded, the lake air temperature and water summer temperatures were 9.92–12.38°C and 13.9–15.8°C in 2017 and 2018, respectively. The lake air temperatures during the cold summers in 1921–1923 and 1974

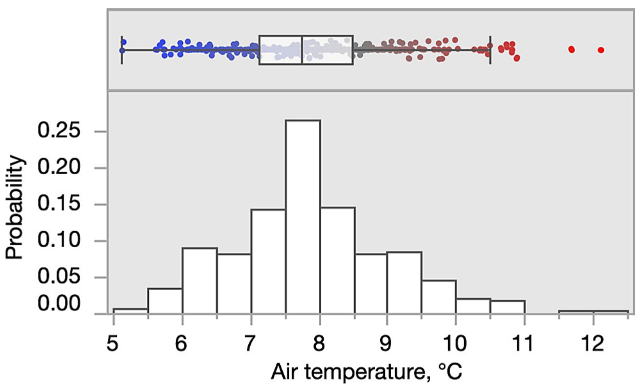

Figure 5. The distribution of average summer (1 July – 15 September) lake air temperature in 391 lakes with *Lepidurus arcticus*. The box-and-whiskers plot shows the interquartile range (IQR) as a box with the median as a vertical line, whereas the whiskers represent the 25-percentile - 1.5 IQR and 75-percentile + 1.5 IQR, respectively. Individual lake air temperatures are shown by a continuous colour scale (blue - gray -red) as in Figure 4.

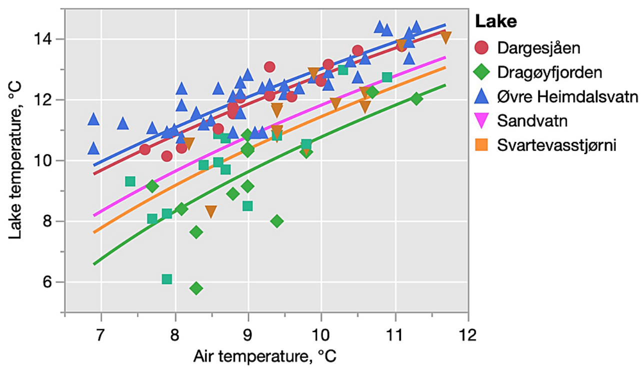

Figure 7. Regression curves for average summer (1 July – 15 September) water temperature as a function of lake air temperature for five lakes with *Lepidurus arcticus*. The curves are based on results from an analysis of covariance (ANCOVA) with water temperature as response variable and lake air temperature (log transformed), lake and their interactions as predictors: n = 97, R^2 = 0.79; whole model test, $F_{9,87}$ = 36.69, p < 0.001; test for effects: log temperature, $F_{1,87}$ = 147.45, p < 0.001; lake, $F_{4,87}$ = 3.89, p = 0.006; interactions, $F_{4,87}$ = 2.93, p = 0.025.

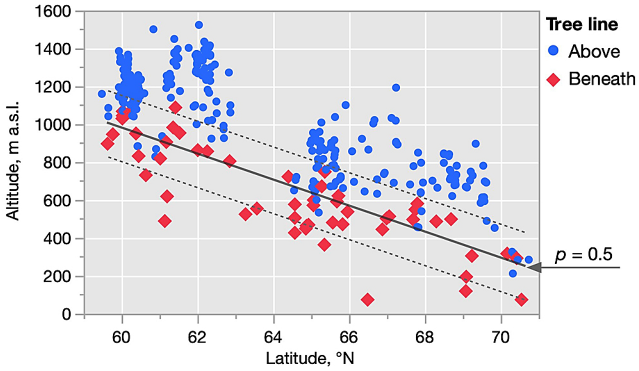

Figure 8. The occurrence of *Lepidurus arcticus* in relation to altitude and treeline of 391 natural *Lepidurus* lakes in the Scandes. Lakes marked as "Beneath" also include lakes on the treeline. The curve, based on a logistic regression, shows the 0.5 probability contour line (with 95 % confidence band): p(beneath) = $(1 + e^{(-87.659 + 0.0171 \cdot Altitude + 1.180\ Latitude)})^{-1}$, $\chi^2 = 173.4$, d.f. = 2, p<0.0001; test for effects: altitude, $\chi^2 = 168.5$, $p < 0.0001$; latitude, $\chi^2 = 91.4$ $p < 0.0001$. The treeline decreases from about 1000 m a.s.l. in the south to 200 m a.s.l. north to 70°N.

were at the same level as in the cold summer of 2017. That summer the water temperatures were near 14°C. This indicates that the water temperature in this lake tends to be regularly above 14°C, even in cold summers.

The treeline altitude at *Lepidurus* lakes

Most of the 391 *Lepidurus* lakes are situated above the treeline (87%). The treeline approximately follows the 9°C isotherm (1 July – 15 September) which compares to a mean July normal of 10.1°C (cf. Table 1). The treeline decreases from 1050 to 350 m a.s.l. from 60 to 70°N, respectively (Figure 8, Appendix 1).

DISCUSSION

Water temperature is a vital environmental factor both by acting directly on freshwater organisms but the cumulative effect throughout the life cycle may also be of primary concern. In this paper our main focus is to get an indication of the upper thermal threshold for *L. arcticus*, which simply means: "when is a lake too warm to host this crustacean?"

The geographic distribution of *Lepidurus* lakes in the Scandes

The central tendency regarding lake altitude of *Lepidurus* lakes is that they decrease from 1200 to 500 m a.s.l. along a south – north transect. Most lakes were distributed around the 8°C isotherm and a lake with lake air temperatures near to this isotherm holds water temperatures from 8 to 12°C. Hence, a majority of the *Lepidurus* lakes have thermal conditions near to the species' highest metabolic rate at approximately 10°C (Lakka 2013) where the hatching rate is also most effective (Pasquali *et al.* 2019).

Most *Lepidurus* lakes are located at a lower lake air temperature than the 10°C isotherm and in warmer areas *L. arcticus* seems to be rare. The distribution appears to be dichotomous, with one northern and one southern "island". Only two *Lepidurus* lakes are known between 62.9 and 64.4°N. In this particular region, the 10°C isotherm lies between 600 and 700 m a.s.l. As lakes in this part of the Scandes are mainly found at lower altitudes, we assume the majority to be too warm to host *L. arcticus*. In the northernmost part, e.g. north to 70°N, the 10°C isotherm is found below 250 m a.s.l. The *Lepidurus* lakes in this area are all located close to this level. As only few lakes are situated higher than 300 m a.s.l. in this northern part of the Scandes, we assume that the potential of new findings is limited. Further north, on Bear Island and Spitsbergen, the species is mainly coastal (Sømme 1934; Røen 1962; Klemetsen 1985; Lakka 2013). In these northern islands, normal air temperature is less than 5°C. Hence, summer temperature seems to be an important factor in orchestrating distribution.

Lepidurus arcticus is also regarded to be sensitive to fish predation, especially in the Arctic and the High Arctic (Jeppesen *et al.* 2001; Presthus Heggen *et al.* 2010). However, *L. arcticus* regularly coexists with fish in the Scandes where only 3% of the *Lepidurus* lakes were fishless. In contrast to Spitsbergen and Bear Island, the *Lepidurus* lakes are relatively deep (70% are deeper than 10 m). This may provide the necessary refugia for an enhanced survival (Qvenild & Hesthagen 2019).

The upper thermal threshold for *Lepidurus arcticus*

Few *Lepidurus* lakes have a lake air temperature higher than 11°C (cf. Figure 5). A lake which have lake air temperature at this level tends to have water temperature close to 14°C (cf. Figure 6). Water temperatures higher than this are scarcely noted in *Lepidurus* lakes in our study. Hence, we assume the upper thermal threshold for *Lepidurus* lakes to be close to the 14°C level. This result seen in the distribution pattern is also confirmed in the long-term study in Lake Skurdalsvatnet in the 1920s. Lake Skurdalsvatnet is situated at 782 m a.s.l. and is warmer than the lakes higher up on Hardangervidda. In this lake, *L. arcticus* was never recorded even though all the upstream lakes hold viable populations of the species (Dahl 1917, 1926, 1932; Amundsen 1976). Even in cold periods, Lake Skurdalsvatnet seemed to have water temperatures of approximately 14°C, i.e. near the upper thermal threshold. With drifting of *L. arcticus* from the lakes upstream, the species would have established as it quickly did in the impounded Lake Pålsbufjorden further downstream, when offered a colder environment (Dahl 1932).

A regional climatic forcing will not necessarily induce a common water temperature response, due to the influence of catchment properties on the water temperature regime (Kvambekk & Melvold 2010). This implies later ice break-up and colder water in catchments with heavy snow deposits (Raddum & Fjellheim 2002; Christoffersen *et al.* 2008; Borgstrøm 2016; Qvenild & Hesthagen 2019). We assume that this is the main reason why some of the *Lepidurus* lakes are located at rather low altitudes, i.e. the westernmost lakes on Vikafjellet in Vestland county and Lake Rundvatn in Nordland county, both locations with winter precipitation more than 1600 mm. In such lakes, the water temperature may be near the lake air temperature or even below after winters with heavy snow falls. The same result was also noted in lakes with a strong oceanic component on the western part of Hardangervidda. This is reflected in a wider range of water temperatures at low lake air temperatures as revealed in the nonlinear relationship in Figure 6.

Early life survival

Branchiopod crustaceans rely on banks of resting eggs to bridge periods of drought or frost and to buffer against the effects of environmental variability (Brendonck 1996). This is evident from the fact that only a fraction of the eggs normally hatches (Hann & Lonsberry 1991; Pasquali *et al.* 2019).

Adult *L. arcticus* seem to tolerate rather high temperatures, but the juvenile phase may be more susceptible to abrupt temperature changes that may result in lethal physiological injuries (Pasquali *et* *al.* 2019). Also, the moult has proved to be a vulnerable stage (Thiéry 1997). In Lake Solvatnet at Spitsbergen, no hatching of *L. arcticus* was observed at 15 and 25°C in the laboratory, and it was assumed that such conditions exceeded the physiological tolerance of the eggs (Pasquali *et al.* 2019). In natural lakes, abrupt changes in water temperature in the initial phase following ice break-up, may frequently occur. In Lake Øvre Heimdalsvatn in 2018, the water temperature increased from 4 to 14°C in only 10 days (Hydra II, nve.no). In small and shallow lakes and ponds such temperature shocks are even more likely to occur.

The hatching phase and the pelagic larval phase has also proved to be vulnerable to acid water. During the spring with heavy snow melt at ice break-up, a drop in pH is frequently measured (Fjellheim *et al.* 2002). This may be harmful or fatal to the larvae (Borgstrøm & Hendrey 1976). Hence, we assume that the juvenile phase of *L. arcticus* to be critical in terms of evaluating risks of extinction.

Life cycle mismatches

As in almost all Brachiopoda, *L. arcticus* has both dormant and subitaneous embryos (Borgstrøm & Larsson 1974; Fryer 1988; Lakka, unpubl.). Newly hatched eggs deposited in water reveal a need for a certain amount of degree days to hatch. Eggs from adult *L. arcticus* sampled in August and incubated at 4 to 5°C, hatched in February (Borgstrøm & Larsson 1974). A recent experiment with eggs from a natural Finnish lake in August which were incubated at a water temperature of 1 to 3°C, hatched in June (Lakka, unpubl.). Even though these results were achieved in the laboratory, it indicates a cumulative need of thermal energy to fulfil the embryonic development. This is in line with general embryonic development for a variety of different taxa (Gillooly & Dodson 2000). We assume that the results achieved by Lakka reflects the real environmental condition met by the *L. arcticus* eggs in the dormant phase through winter.

Since eggs remain viable for years when dry or frozen, it is assumed that development of the embryos is arrested. The small and shallow Lake Solvatnet at Spitsbergen freezes solid in winter, the eggs freeze, and development of the embryos are arrested (Pasquali *et al.* 2019). Eggs picked after ice-break up and incubated at 5 and 10°C start to hatch after 15 and 7 days, respectively. Hence, eggs incubated at 5°C in Solvatnet needed much shorter time to hatch than the eggs incubated at 4 to 5°C from the lake studied by Borgstrøm & Larsson (1974) and Lakka (unpubl.). Thus, some of the development in the embryonic phase must have occurred in the previous summer or earlier. This emphasizes the significance of the egg bank as a buffer to variable environmental conditions (Hann & Lonsberry 1991; Brendonck 1996). In natural lakes in the Scandes, the resting eggs are deposited in the littoral zone, normally with water temperature between 1 and 2°C in winter. Thus, the embryos will develop continuously during winter. As the eggs are laid in August – September, their thermal path through dormancy may take different ways depending on water temperature, to hatching in June – July. A warm summer usually results in a high thermal load on a yearly basis (Kvambekk & Melvold 2010). With a too high cumulation of thermal energy during the first period of the embryonic phase, life cycle mismatches may be the consequence. If the required thermal input to fulfil the embryonic phase are achieved by elevated temperatures in autumn/ winter, the eggs may hatch under complete dark conditions in winter. We assume this mismatch between environmental conditions and life-cycle events to be the main reason for the absence of *L. arcticus* in warm lowland lakes in the Scandes.

Lepidurus arcticus populations at threat

Whereas *L. arcticus* seems to be common in Norway, it has been red listed as near-threatened (NT) in Sweden and endangered (EN) in Finland. Given its Arctic origin and its susceptibility to acid precipitation and predation pressure from co-existing fish populations, we assume that many populations have gone extinct in the Scandes.

Historically, a range retraction is evident by the fact that *L. arcticus* had a much wider distribution according to fossil records from different parts of Europe (Økland & Økland 2003). From Norway, fossil remnants of *L. arcticus* were found in the Brøndmyra bog (59.4825°N, 7.5211°E) 14 m a.s.l. (Arne Fjellberg, pers. comm.). This locality is located 131 km southwest of the southernmost record of *L. arcticus*, in Lake Nørdre Gjuvvatn in southern outskirt of the Scandes.

As shown in this study, the distribution of *L. arcticus* mainly follows the alpine zone. There are some exceptions where it occurs in the lower subalpine birch zone. In total, 87% of the studied lakes are situated above the treeline. The present treeline in the Scandes is formed by birch, and it is assumed to mainly be a response of climatic conditions (Dahl & Nesje 1996; Odland 1996). The treeline at the *Lepidurus* lakes in this study closely follows the summer isotherm near 9°C which agrees with that stated for birch (Odland 1996). The warm period in early-Holocene (7800–7600 BP) may be regarded as an early analogue for possible increased precipitation as a result of continued greenhouse warming (Dahl & Nesje 1996). Both pine (*Pinus sylvestris*) and birch then extended their distribution to altitudes far above the present treeline (Moe 1979; Aas & Faarlund 1988; Dahl & Nesje 1996). In the first two decades of the 2000s, the mean summer temperature has risen to a level above 1°C compared to the normal period (cf. Table 1) and a further increase is projected (Hanssen-Bauer *et al.* 2017). This compares to a significant raise in the treeline which may reach levels seen in the early- to mid-Holocene. Thus, in the early- to mid-Holocene, the range retractions of *L. arcticus* may have been massive if it followed the treeline extension. We assume that a later recolonization in colder lakes formed the present occurrences in the Scandes. Hence, we assume the treeline to be an indicator of a possible range retraction of *L. arcticus* populations from the lower part of its distribution area.

The aquatic environment is rapidly changing in the Scandes and continuous monitoring programs are needed. The only long-term program in the Scandes with repeated monitoring of environmental conditions and biota is Lake Øvre Heimdalsvatn (Brittain *et al.* 2019). In this lake situated at the present treeline, *L. arcticus* has practically been absent from brown trout diet since 1993 (Brittain *et al.* 2019). Predation from brown trout and Eurasian minnow is obviously of prime concern for the occurrence of *L. arcticus* in this lake, but an additive stressor is likely to be the significant warming seen after 2000. Thus, a further warming may be detrimental to the *L. arcticus* population in the lake. Here, and in the many *Lepidurus* lakes with more than ten-year-old observations, updated surveys would be highly rewarding and possibly disclose extinct populations in some lakes. The cold adapted *L. arcticus* may be a good indicator species to changing environmental conditions (Lakka 2013, 2020).

CONCLUSIONS

Lepidurus arcticus is recorded in 479 locations in the Scandes, making this southern outreach to be a significant part of the species' total distribution area. The central tendency in the distribution regarding lake altitude is that it decreases from about 1200 to 500 m a.s.l. along a south-north transect. Most of the lakes were distributed around the 8°C isotherm, indicating water temperatures from 8 to 12°C. This is near to the species' highest metabolic rate at approximately 10°C where the egg hatching rate is also most effective. The majority of *Lepidurus* lakes are located at a lower lake air temperature than the 11°C isotherm which is equivalent to a water temperature near 14°C. In warmer lakes, *L. arcticus* seems to be rare and water temperatures above 14°C may be regarded as critical. Lice cycle mismatches seem to be the main reason in lakes warmer than this. The juvenile stage also seem to be very sensitive to abrupt changes in water temperature.

In total, 87% of the studied lakes are situated above the treeline which closely follows the summer isotherm near to 9°C. The treeline has proved to give a direct response to altered climate conditions and thus, the treeline may be an indicator of a possible range retraction of *L. arcticus* populations in the lower part of its distribution area. An increase of more than 1°C is already experienced in the first two decades of the 2000s. The widespread trend of warming lakes is anticipated to continue unabated and does not augur well for the fate of cold-water adapted species. Far more water temperature monitoring locations should be established to get a better prediction of freshwater ecosystems effects of global warming. *Lepidurus arcticus* may be a good indicator species of arctic and alpine aquatic communities, and a continuous monitoring program following *Lepidurus* lakes near to and below the treeline, would be highly rewarding. The upper thermal threshold of approximately 14°C may be used to evaluate *Lepidurus* lakes at threat.

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Appendix 1. The occurrence of 479 lakes hosting *Lepidurus arcticus* in the Scandes of which 391 are natural lakes and 88 regulated. (Abbrevations are given beneath the table).

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	13693	Nørdre Gjuvvatn	Bykle	Agder	1 160	0.465	800				Bt	+	59.48250	7.52116	Lindås 1994
Norway	1072	Hartevatn	Bykle	Agder	759	5.690	800	7.0			Bt,Em	-	59.53600	7.35086	Lindås 1994
Norway	1058	Breidvatn	Bykle	Agder	897	3.467	800				Bt,Em	-	59.63145	7.43832	Lindås 1993
Norway	1075	Langvatn	Bykle	Agder	1 042	2.164	800				Bt	+	59.64517	7.22691	Lindås 1994
Norway	13098	Svartepoddvatnet	Bykle	Agder	1 086	0.432	800				Bt	+	59.64868	7.13351	Lindås 1994
Norway	1078	Sæsvatnet	Vinje	Vestfold og Telemark	897	3.576	800	2.5			Bt,Em	-	59.65568	7.45941	Lindås 1993
Norway	86	Øvre Langeidvatn	Vinje	Vestfold og Telemark	886	7.740	811	7.0	15.0	50.0	Bt,Em	-	59.69271	7.57159	H. Kaasa, pers. comm.
Norway	1875	Holmavatn	Vinje	Vestfold og Telemark	1 058	10.817	800	10.0			Bt	+	59.69413	7.14901	NOU 1974
Norway	12674	Våtjern	Hjartdal	Vestfold og Telemark	947	0.211	400				Bt	-	59.77190	8.56163	T. Hesthagen, pers. comm.
Norway	61	Kjelavatn	Vinje	Vestfold og Telemark	944	5.280	800	26.0			Bt,Em	0	59.79287	7.22353	Solhøi 1995
Norway	3	Møsvatn	Vinje	Vestfold og Telemark	919	78.774	400	18.5			Bt,Ac,Em	-	59.82999	8.09041	Aass 1969
Norway	62	Ståvatn	Vinje	Vestfold og Telemark	979	6.490	800	12.5			Bt,Em	+	59.83051	7.16309	Solhøi 1995
Norway	10	Songa	Vinje	Vestfold og Telemark	974	30.012	700	35.0			Bt,Em	-	59.85230	7.56498	Aass 1969
Norway	12053	Kolsnutgrysline	Vinje	Vestfold og Telemark	1 386	0.504	500				Bt	+	59.92821	7.77618	Walseng et al. 1994
Norway	12030	Ugletjørni	Vinje	Vestfold og Telemark	1 195	0.884	600				Bt	+	59.93009	7.60835	T. Simonsen, pers. comm.
Norway	37	Langesjå	Tinn	Vestfold og Telemark	1 145	6.986	351				Bt	+	59.93368	8.30317	Lier-Hansen 1980
Norway	41	Store Meinsvatn	Vinje	Vestfold og Telemark	1 384	1.403	500				Bt	+	59.93666	7.73133	Walseng et al. 1994
Norway	40	Urdevatnet	Vinje	Vestfold og Telemark	1 329	1.548	500				Bt	+	59.96196	7.71315	Walseng et al. 1996
Norway	11836	Vesle Meinsvatnet	Vinje	Vestfold og Telemark	1 353	0.573	500				Bt	+	59.96938	7.75136	Walseng et al. 1994
Norway	11743	Hedlevatnet	Vinje	Vestfold og Telemark	1 161	2.068	650				Bt	+	59.97521	7.26511	Gulbrandsen et al. 1986
Norway	11763	Møruvatnet	Vinje	Vestfold og Telemark	1 163	0.469	600				Bt	+	59.98586	7.63412	Kildal & Kaasa 1973
Norway	12	Vollevatnet	Vinje	Vestfold og Telemark	1 030	1.665	605		3.3	11.5	Bt	-	60.02231	7.72235	Kildal 1980
Norway	13	Briskevatnet	Vinje	Vestfold og Telemark	1 068	2.617	611		8.2	22.1	Bt	0	60.02711	7.62862	Kildal 1980
Norway	107	Store Saure	Tinn	Vestfold og Telemark	1 120	1.626	350				Bt	+	60.02766	8.10867	J.H. L'Abbée-Lund, pers. comm.
Norway	16	Øvre Bjørnavatnet	Ullensvang	Vestland	1 147	2.921	659				Bt	+	60.02878	7.29511	Muniz 1968
Norway	19079	Honserudvatnet	Vinje	Vestfold og Telemark	1 045	0.379	600				Bt	-	60.02906	7.69519	Kildal & Kaasa 1975
Norway	14	Gunleiksbuvatnet	Vinje	Vestfold og Telemark	1 071	1.292	652		1.6	7.2	Bt	+	60.02960	7.55126	Kildal 1980
Norway	93	Vråsjåen	Vinje	Vestfold og Telemark	1 115	2.680	350				Bt	+	60.03711	8.04754	NOU 1974
Norway	15	Nedre Bjørnavatnet	Ullensvang	Vestland	1 136	2.131	650				Bt	+	60.03714	7.35971	Walseng et al. 1996

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	18923	Tuevatni	Vinje	Vestfold og Telemark	1 288	0.258	700				Bt	+	60.05344	7.24466	Muniz 1968
Norway	17	Sandvatn	Vinje	Vestfold og Telemark	1 112	1.570	696		2.6	13.0	Bt	+	60.05579	7.48441	Kildal 1980
Norway	75	Gøystvatnet	Tinn	Vestfold og Telemark	1 087	31.263	350	11.6			Bt,Em	+	60.05636	8.26001	Sømme S 1934
Norway	19	Kvennsjøen	Ullensvang	Vestland	1 166	4.997	750				Bt	+	60.06699	7.19645	Muniz 1968
Norway	18	Nedre Krokavatn	Ullensvang	Vestland	1 141	1.164	700				Bt	+	60.07374	7.39086	Kildal 1982a
Norway	18854	Kringlesjåen	Vinje	Vestfold og Telemark	1 255	0.716	493		4.5	14.0	Bt	+	60.07392	7.60857	Kildal 1981
Norway	78	Gjuvsjåen	Vinje	Vestfold og Telemark	1 210	5.110	439				Bt	+	60.07465	7.83678	NOU 1974
Norway	66946	Midtre Krokavatn	Ullensvang	Vestland	1 141	0.929	700				Bt	+	60.07467	7.33593	Kildal 1982a
Norway	38	Skardvatnet	Vinje	Vestfold og Telemark	1 149	0.969	600				Bt	+	60.07485	7.70954	Kildal 1981
Norway	18827	Dargesjåen	Vinje	Vestfold og Telemark	1 205	0.641	600		4.7	15.0	Bt	+	60.07881	7.57962	Kildal 1981
Norway	18773	Krokavatni	Ullensvang	Vestland	1 150	1.214	750				Bt	+	60.08273	7.30212	Kildal 1982a
Norway	43	Litlosvatnet	Ullensvang	Vestland	1 170	1.518	827		10.2	25.0	Bt	+	60.08500	7.14114	Muniz 1968
Norway	103	Reksjå	Tinn	Vestfold og Telemark	1 207	2.806	300				Bt	+	60.08989	8.12556	NOU 1974
Norway	18770	Blånuttjørnane	Vinje	Vestfold og Telemark	1 310	0.313	512		6.1	31.0	Bt	+	60.09135	7.50603	Rognerud et al. 2005
Norway	39	Fjellsjåen	Vinje	Vestfold og Telemark	1 195	2.314	495		8.1	26.0	Bt	+	60.09610	7.62599	Kildal 1981
Norway	18700	Kollsvatnet	Ullensvang	Vestland	1 182	0.612	845		6.5	13.0	Bt	+	60.09746	7.10425	Muniz 1968
Norway	92	Rosjå	Tinn	Vestfold og Telemark	1 174	2.030	298				Bt	+	60.09804	8.41068	Bjørtuft & Saltveit 1993
Norway	18679	Sletteidvatni	Tinn	Vestfold og Telemark	1 302	0.991	300				Bt	+	60.10014	8.03536	Sømme S 1934
Norway	94	Kallungsjåen	Vinje	Vestfold og Telemark	1 246	3.172	300				Bt	+	60.10153	7.94158	NOU 1974
Norway	18721	Ljostjørn	Tinn	Vestfold og Telemark	1 178	0.425	300				Bt	+	60.10540	8.41409	Bjørtuft & Saltveit 1993
Norway	42	Valgardsvatni	Ullensvang	Vestland	1 319	1.843	700				Bt	+	60.11255	7.32329	Muniz 1968
Norway	18597	Skavatn	Ullensvang	Vestland	1 249	0.472	800		5.7	15.0	Bt	+	60.11468	7.14661	Gjøstein & Hauge 1994
Norway	18558	Krokavatnet	Ullensvang	Vestland	1 236	0.424	800		8.6	16.0	Bt	+	60.11915	7.08468	Kildal 1982b
Norway	36	Mår	Tinn	Vestfold og Telemark	1 121	20.555	300	21.3			Bt	+	60.12356	8.23089	Sømme S 1934
Norway	18434	Grøndalsvatni	Ullensvang	Vestland	1 281	0.218	800				Bt	+	60.13647	7.09754	Madsen 1970-1988
Norway	18409	Grøndalsvatni	Ullensvang	Vestland	1 268	0.555	800				Bt	+	60.14012	7.12489	Borgstrøm 2003
Norway	421	Dimmedalsvatnet	Eidfjord	Vestland	1 334	1.700	550				Bt	+	60.14032	7.36849	Muniz 1968
Norway	18374	Bismarvatnet	Eidfjord	Vestland	1 331	1.880	550				Bt	+	60.14361	7.32778	Muniz 1968
Norway	109	Viuvatnet	Tinn	Vestfold og Telemark	1 324	3.033	345				Bt	+	60.14427	7.99602	NOU 1974
Norway	108	Kalven	Nore og Uvdal	Viken	1 294	1.354	300				Bt	+	60.15770	7.96405	Løkensgard 1975

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	18305	Y-tjørn	Eidfjord	Vestland	1 330	0.036	550				Bt	+	60.16145	7.34852	Muniz 1969
Norway	18289	X-tjørn	Eidfjord	Vestland	1 326	0.037	550				Bt	+	60.16498	7.34739	Muniz 1969
Norway	419	Lakjen	Eidfjord	Vestland	1 243	3.115	550				Bt	+	60.16698	7.51870	Muniz 1969
Norway	18224	Herrevatnet	Eidfjord	Vestland	1 367	0.463	586				Bt	+	60.17166	7.29813	Eidfjord fjellstyre
Norway	18228	Nykktjørnane	Eidfjord	Vestland	1 317	0.142	500				Bt	+	60.17446	7.26411	Muniz 1969
Norway	418	Bjornesfjorden	Nore og Uvdal	Viken	1 223	18.380	512				Bt	+	60.17599	7.66691	Sømme ID 1931
Norway	104	Hettefjorden	Nore og Uvdal	Viken	1 228	2.327	300				Bt	+	60.17666	8.01864	Løkensgard 1975
Norway	18208	Gravagjelstjønn	Eidfjord	Vestland	1 346	0.211	550				Bt	+	60.17761	7.34526	Muniz 1969
Norway	18164	Øvre Krakavadtjørni	Nore og Uvdal	Viken	1 225	0.737	500				Bt	+	60.18549	7.58974	Sømme ID 1936
Norway	420	Nordmannslågen	Eidfjord	Vestland	1 244	10.882	547				Bt	+	60.18970	7.45041	Muniz 1969
Norway	96	Eidsjoren	Nore og Uvdal	Viken	1 229	2.055	300				Bt	+	60.19132	7.96459	Løkensgard 1975
Norway	1913	Omkjelsvatnet Nedre	Ullensvang	Vestland	1 199	2.386	871				Bt	+	60.20117	6.95946	Vasshaug 1970
Norway	18034	Djupavatnet	Ullensvang	Vestland	1 291	0.140	840				Bt	+	60.2044	7.0016	Own data
Norway	18023	Storfisktjørni	Nore og Uvdal	Viken	1 235	1.127	500				Bt	+	60.20656	7.59750	NOU 1974
Norway	17997	Heisantjørnane	Eidfjord	Vestland	1 244	0.198	550				Bt	+	60.21637	7.36522	Borgstrøm et al. 2010
Norway	409	Vikvatn	Nore og Uvdal	Viken	1 064	1.221	300				Bt	0	60.21763	8.38858	Løkensgard & Rosseland 1963
Norway	410	Smågefjorden	Nore og Uvdal	Viken	1 172	2.374	350				Bt	+	60.21954	8.24994	NOU 1974
Norway	17949	Sønstevatnet	Nore og Uvdal	Viken	1 060	12.533	300	31.1			Bt	+	60.22038	8.55774	Løkensgard & Rosseland 1963
Norway	17959	Holmavatn	Eidfjord	Vestland	1 260	0.099	800				Bt	+	60.22689	7.41693	Madsen 1970-1988
Norway	17965	Skrovstjørni	Nore og Uvdal	Viken	1 222	0.134	500				Bt	+	60.22779	7.62788	NOU 1974
Norway	17979	Kvonneviertjørni	Nore og Uvdal	Viken	1 103	0.108	300				Bt	+	60.22920	8.34537	NOU 1974
Norway	17898	Nordvatnet	Eidfjord	Vestland	1 256	1.018	552				Bt	+	60.23467	7.38641	Muniz 1969
Norway	17878	Kinsevatnet	Ullensvang	Vestland	1 184	0.256	900				Bt	+	60.23777	6.97071	Madsen 1970-1988
Norway	17899	Kleivshovdtjørnane	Eidfjord	Vestland	1 214	0.438	500				Bt	+	60.24019	7.61784	NOU 1974
Norway	17849	Bersavikvatnet	Ullensvang	Vestland	1 231	1.654	785		8.6	34.0	Bt	+	60.24054	7.05407	Madsen 1970-1988

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	17865	Kleivshovdtjørnane	Eidfjord	Vestland	1 215	0.818	500				Bt	+	60.24520	7.58941	Muniz 1969
Norway	395	Langesjøen	Nore og Uvdal	Viken	1 210	11.044	441		4.0	16.0	Bt	+	60.24520	7.74152	Dahl 1917
Norway	17843	Vestre Bakketjørn	Nore og Uvdal	Viken	1 211	1.635	500				Bt	+	60.24553	7.66411	NOU 1974
Norway	17750	Holmetjørnane	Nore og Uvdal	Viken	1 207	0.773	450				Bt,Em	+	60.24817	7.69417	NOU 1974
Norway	279619	Vestre Bakketjørn	Nore og Uvdal	Viken	1 212	1.295	500				Bt	+	60.25281	7.64804	NOU 1974
Norway	1910	Langavatnet	Eidfjord	Vestland	1 222	2.650	542				Bt	+	60.25650	7.51803	Muniz 1969
Norway	1912	Veivatnet	Ullensvang	Vestland	1 172	4.677	893		16.0	53.4	Bt	+	60.25841	6.90824	Madsen 1970-1988
Norway	17826	Flotatjørni	Nore og Uvdal	Viken	1 209	0.775	423				Bt	+	60.26209	7.80403	Myrvang & Slettebø 2013
Norway	416	Skrykken	Nore og Uvdal	Viken	1 158	5.093	400				Bt	+	60.26804	8.07946	Dahl 1917
Norway	27430	Tinnhølen	Eidfjord	Vestland	1 213	4.538	528				Bt	+	60.26832	7.60062	Muniz 1969
Norway	27533	Holmavatnet	Ullensvang	Vestland	1 186	0.564	900		3.4	15.0	Bt	+	60.27482	6.94927	Wiers & Hylland 2001
Norway	17737	Tresnutvatnet	Ullensvang	Vestland	1 193	0.218	800		5.5	14.5	Bt	+	60.27979	6.99024	Wiers & Hylland 2001
Norway	17735	Skinhovda	Ullensvang	Vestland	1 152	0.497	800		12.3	33.0	Bt	+	60.28066	7.01625	Wiers & Hylland 2001
Norway	17715	Vatnalivatnet	Ullensvang	Vestland	1 045	0.640	750				Bt	+	60.28421	7.07652	Borgstrøm & Dokk 2000
Norway	66954	Hølen	Nore og Uvdal	Viken	1 157	0.465	400				Bt	+	60.28478	8.00999	Dahl 1917
Norway	17746	Stigstuvtjørni	Eidfjord	Vestland	1 212	0.058	500				Bt,Em	+	60.28684	7.64995	NOU 1974
Norway	17720	Stigstutjørni	Eidfjord	Vestland	1 220	0.054	500				Bt	+	60.29421	7.65067	NOU 1974
Norway	385	Skarvsvatnet	Nore og Uvdal	Viken	1 117	3.684	400				Bt	+	60.30599	8.20989	NOU 1974
Norway	27495	Lonavatnet	Ullensvang	Vestland	1 125	0.523	900				Bt	+	60.30812	6.91671	Madsen 1970-1988
Norway	17682	Kalvetjørnan	Nore og Uvdal	Viken	1 170	0.432	450				Bt,Em	+	60.30928	7.76253	NOU 1974
Norway	394	Geitsjøen	Nore og Uvdal	Viken	1 112	3.224	496		7.0	22.8	Bt	+	60.31244	7.98856	Dahl 1917
Norway	17616	Vasslivatn	Ullensvang	Vestland	1 041	0.849	750		5.6	26.4	Bt	+	60.32107	7.06304	Madsen 1970-1988
Norway	27478	Stavalivatnet	Ullensvang	Vestland	900	0.690	900	3.4	5.4	23.8	Bt	+	60.32309	6.84635	Vasshaug 1970
Norway	411	Tøddølvatnet	Nore og Uvdal	Viken	1 101	1.291	300				Bt	+	60.32653	8.27454	NOU 1974

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	17617	Store Selstjørni	Nore og Uvdal	Viken	1 135	0.492	500				Bt	+	60.33287	7.90200	NOU 1974
Norway	17583	Nedre Hein	Nore og Uvdal	Viken	1 075	1.232	450				Bt,Em	+	60.34435	7.97929	Amundsen 1976
Norway	428	Skaupsjøen	Eidfjord	Vestland	1 155	2.945	500				Bt,Em	+	60.35602	7.68224	NOU 1974
Norway	66935	Heintjønne	Nore og Uvdal	Viken	1 112	0.583	500				Bt,Em	+	60.36201	7.90549	Amundsen 1976
Norway	390	Orsjoren	Hol	Viken	951	2.365	424				Bt,Ac,Em	-	60.37663	8.21382	Dahl 1917
Norway	17477	Skiftesjøen	Eidfjord	Vestland	1 236	0.823	521				Bt	+	60.38001	7.56483	Fjellheim et al. 2002
Norway	414	Øvre Hein	Nore og Uvdal	Viken	1 113	6.335	450				Bt,Em	+	60.38155	7.85172	Amundsen 1976
Norway	415	Halnefjorden	Hol	Viken	1 130	13.701	500	4.0			Bt,Em	+	60.38251	7.76445	Sømme S 1934
Norway	17460	Orsjøtjørni	Hol	Viken	1 079	0.434	350				Bt,Ac,Em	+	60.39197	8.13712	Amundsen 1976
Norway	17454	Bjordalsvatn	Hol	Viken	1 121	0.520	350				Bt,Ac	+	60.39592	8.06154	Sømme S 1934
Norway	17402	Dyratjørnane	Eidfjord	Vestland	1 173	0.247	600				Bt	+	60.40599	7.58782	Madsen 1970-1988
Norway	17401	Ljosevatnet	Hol	Viken	1 182	0.903	350				Bt	+	60.40809	8.18495	Sømme S 1934
Norway	17397	Heinumgen	Hol	Viken	1 138	0.365	450				Bt,Em	+	60.41095	7.82034	Amundsen 1976
Norway	17366	Nedre Bjørkevatn	Hol	Viken	1 161	0.841	350				Bt,Ac,Em	+	60.41663	8.10481	Amundsen 1976
Norway	17369	Svartetjørni	Eidfjord	Vestland	1 141	0.144	600				Bt	+	60.41947	7.54511	Eidfjord fjellstyre
Norway	17371	Skjerjavatnet	Hol	Viken	1 192	1.572	369		1.7	6.0	Bt,Em	+	60.41988	7.96826	Mollerud 1971
Norway	1907	Sysenvatn	Eidfjord	Vestland	940	10.423	700	66.0			Bt,Ac	+	60.42087	7.41434	Jensen 1975
Norway	375	Tunhovdfjorden	Nore og Uvdal	Viken	734	25.555	300	18.2			Bt,Ac,Em	-	60.42090	8.86137	Aass 1969
Norway	27433	Vetlevatnet	Eidfjord	Vestland	884	0.061	550				Bt	+	60.42221	6.94813	Wiers & Hylland 2002
Norway	391	Veslekrækkja	Hol	Viken	1 148	1.979	450		4.3	15.5	Bt,Em	+	60.42641	7.79458	Amundsen 1976
Norway	17300	Busetevatnet	Eidfjord	Vestland	884	0.432	550		6.7	22.5	Bt	+	60.42747	6.96097	Wiers & Hylland 2002
Norway	17305	Inste Olavsbuvatni	Eidfjord	Vestland	1 175	0.645	500				Bt	+	60.42856	7.63768	Madsen 1970-1988
Norway	17318	Langetjørni	Hol	Viken	1 201	0.315	350				Bt	+	60.43555	7.99034	Dahl 1917
Norway	17289	Halnetjørni	Eidfjord	Vestland	1 259	0.157	500				Bt	+	60.43952	7.65718	Madsen 1970-1988
Norway	17297	Svantjørni	Hol	Viken	1 129	0.214	400				Bt	+	60.44032	8.17727	Amundsen 1976
Norway	17281	Holværvatnet	Hol	Viken	1 183	1.431	355		8.9	28.0	Bt,Ac	+	60.44169	8.08834	Dahl 1917
Norway	392	Storekrekkja	Hol	Viken	1 151	4.178	450		8.0	26.5	Bt,Em	+	60.44608	7.74452	Tysse & Garnås 1994
Norway	376	Pålsbufjord	Nore og Uvdal	Viken	749	19.644	350	23.5			Bt,Ac,Em	-	60.44619	8.67005	Dahl 1932

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	1906	Isdalsvatnet	Eidfjord	Vestland	832	1.071	726				Bt	-	60.44865	7.29113	Lehmann & Wiers 2004
Norway	67975	Lægreidvatnet	Hol	Viken	1 147	1.736	400	13.0			Bt,Em	+	60.45273	7.83160	Qvenild 1978
Norway	17244	Tuvetjørni	Hol	Viken	1 236	0.196	350				Bt	+	60.45326	8.03896	Dahl 1915
Norway	17224	Tobakkstjørni	Hol	Viken	1 237	0.044	350				Bt	+	60.46024	8.13525	Dahl 1917
Norway	553	Ørteren	Hol	Viken	1 147	9.439	400	13.0			Bt,Em	+	60.46827	7.79207	Borgstrøm 1975
Norway	393	Dragøyfjorden	Eidfjord	Vestland	1 180	3.326	487		10.0	42.0	Bt	+	60.46838	7.68742	H. Stakseng, pers. comm.
Norway	17343	Breidvatnet	Hol	Viken	1 162	1.004	350				Bt,Ac,Em	+	60.47733	8.06594	Dahl 1917
Norway	17104	Øvre Trestiklan	Hol	Viken	1 149	0.483	400				Bt,Em	+	60.48782	7.77488	Enerud & Garnås 1995
Norway	551	Ustevatnet	Hol	Viken	985	17.011	350	17.5			Bt,Ac,Em	-	60.49725	7.94153	Borgstrøm 1972
Norway	17040	Svartevatnet	Eidfjord	Vestland	1 233	1.132	498		6.9	28.0	Bt	+	60.49938	7.71049	Fjellheim et al. 2002
Norway	17018	Svartevasstjørni	Eidfjord	Vestland	1 237	0.396	498		4.8	18.0	Bt	+	60.50951	7.69487	Fjellheim et al. 2002
Norway	1921	Langvatnet	Ulvik	Vestland	1 158	6.399	1850	48.0			Bt	+	60.55668	7.14308	Vasshaug 1970
Norway	16664	Austdalsvatnet	Ulvik	Vestland	1 163	0.321	1850				Bt	+	60.59588	7.24162	Halvorsen 1973
Norway	601	Sudndalsfjorden	Hol	Viken	731	1.680	500		39.0		Bt,Em	-	60.64109	8.04838	Enerud & Garnås 1995
Norway	548	Strandavatnet	Hol	Viken	978	24.070	629	28.0			Bt	0	60.69047	7.84420	Aass 1969
Norway	16403	Vatsfjorden	Ål	Viken	736	1.450	450	-	9.0	23.0	Bt,Ac,Em	-	60.69136	8.39430	Enerud & Garnås 1995
Norway	627	Bergsjøen	Ål	Viken	1 082	1.682	450	11.0			Bt,Ac,Em	+	60.71183	8.29839	Enerud & Garnås 1988
Norway	16035	Øvre Stolsvatnet	Hol	Viken	1 091	36.530	600	13.0			Bt, Em	+	60.75705	8.00203	Aass 1969
Norway	589	Flævatn	Hemsedal	Viken	1 108	16.720	471	19.9			Bt	+	60.83198	8.36486	Aass 1969
Norway	15941	Vesle Øljuvatnet	Hol	Viken	1 501	0.380	792				Bt	+	60.84225	7.76272	Aass 1969
Norway	531	Tisleifjorden	Nord-Aurdal	Innlandet	820	13.130	300	11.5	15.0	37.0	Bt,Em,P	-	60.85646	8.92575	Aass 1969
Norway	532	Storevatnet	Hemsedal	Viken	824	4.885	300	3.0			Bt,Em,P	-	60.86594	8.78355	Enerud & Garnås 1992
Norway	2097	Askjelldalsvatnet	Vaksdal	Vestland	805	2.841	1862	55.0			Bt	+	60.89018	6.18242	Fjellheim & Raddum 2007
Norway	27171	Vetle Askjelldalsvatnet	Vaksdal	Vestland	829	0.276	1850		3.3	12.0	Bt	+	60.89266	6.22050	Hellen et al. 2001
Norway	2100	Selhamarvatnet	Vik	Vestland	869	0.766	1850				Bt	+	60.91177	6.27938	Økland & Økland 2002

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	27149	Vassøyane	Vik	Vestland	866	2.003	1850	1.3			Bt	+	60.91267	6.24077	Raddum & Fjellheim 1994
Norway	1468	Kvilesteinsvatnet	Vik	Vestland	920	3.568	1850	25.0			Bt	+	60.92037	6.32151	Raddum & Fjellheim 1994
Norway	1566	Øljusjøen	Lærdal	Vestland	1 333	8.652	450	26.0			Bt	+	60.95018	8.08159	Aass 1969
Norway	626	Vavatn	Hemsedal	Viken	1 124	5.000	450	8.0	15.0	44.0	Bt	+	60.95963	8.43498	Aass 1969
Norway	1560	Eldrevatn	Lærdal	Vestland	1 116	3.511	498	5.5			Bt	+	61.00538	8.13664	artsdatabanken.no
Norway	572	Leirin	Nord-Aurdal	Innlandet	819	1.716	300				Bt,P,Wf	-	61.02189	9.29752	H. Opsahl, pers. comm.
Norway	1568	Vesle Juklevatnet	Lærdal	Vestland	1 280	0.791	500	3.5			Bt	+	61.02345	8.18034	artsdatabanken.no
Norway	1569	Juklevatnet	Lærdal	Vestland	1 286	3.057	500	7.0			Bt	+	61.02828	8.24818	artsdatabanken.no
Norway	575	Midtre Syndin	Vestre Slidre	Innlandet	937	2.731	295				Bt	+	61.06960	8.75001	Saltveit 1985
Norway	577	Volbufjorden	Øystre Slidre	Innlandet	434	3.900	300	3.0	26.0	65.0	Bt,P,Em	-	61.09761	9.08608	Brabrand & Saltveit 1978
Norway	517	Vangsmjøsa	Vang	Innlandet	466	17.400	300	3.2	68.0	154.0	Bt,Em	-	61.14143	8.55095	Gunnerød et al. 1975
Norway	580	Heggefjorden	Øystre Slidre	Innlandet	489	2.122	300			32.0	Bt	-	61.14266	9.04354	Brabrand et al. 1986
Norway	518	Støgofjorden	Vang	Innlandet	971	2.191	400	5.5		56.0	Bt	-	61.17899	8.18185	Sars 1864
Norway	30739	Vesleåntjernet	Vang	Innlandet	1 191	0.067	400				Bt	+	61.18015	8.25973	T. Reirem, pers. comm.
Norway	561	Fullsenn	Nord-Aurdal	Innlandet	906	5.899	329				Bt	-	61.18173	9.45930	H. Opsahl, pers. comm.
Norway	30727	Vesleskardtjern	Vang	Innlandet	1 256	0.034	400				Bt	+	61.18806	8.14883	Sars 1864
Norway	32987	Hedalsfjorden	Øystre Slidre	Innlandet	619	0.858	300		15.0	34.0	Bt	-	61.19617	8.96486	Brabrand et al. 1986
Norway	1562	Slettningen	Vang	Innlandet	1 228	3.382	433				Bt	+	61.20328	8.12068	T. Løkensgard, pers. comm.
Norway	539	Øyangen	Vang	Innlandet	1 211	5.518	389	31.0			Bt	+	61.24963	8.30834	Borgstrøm 1971
Norway	540	Steinbusjøen	Vang	Innlandet	1 211	8.019	389	31.0			Bt	+	61.26610	8.35439	Aass 1969
Norway	30620	Målnestjernet	Vang	Innlandet	1 266	0.180	350				Bt	+	61.27138	8.26015	T. Løkensgard, pers. comm.
Norway	1573	Tyin	Vang	Innlandet	1 084	33.208	400	10.4		81.0	Bt,Em	+	61.28066	8.20132	Aass 1969
Norway	30596	Stordalstjerni	Vang	Innlandet	1 246	0.225	400				Bt	+	61.29851	8.35436	artsdatabanken.no
Norway	30595	Stordalstjerni	Vang	Innlandet	1 247	0.155	400				Bt	+	61.29860	8.37161	artsdatabanken.no
Norway	32838	Skagstjerni	Øystre Slidre	Innlandet	1 140	0.119	300				Bt	+	61.30101	9.24535	R. Gran, pers. comm.
Norway	30590	Vølodalstjerne	Vang	Innlandet	1 211	0.872	400				Bt	+	61.30745	8.39880	artsdatabanken.no
Norway	145	Vinstre	Øystre Slidre	Innlandet	1 032	28.187	400	4.0			Bt,Em	+	61.31676	8.87246	Aass 1969

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	146	Bygdin	Vang	Innlandet	1 057	40.034	500	9.2		200.0	Bt,Em	+	61.34811	8.57491	Aass 1969
Norway	32747	Nedre Hersjøen	Nord-Fron	Innlandet	983	1.402	300				Bt,Em	-	61.35635	9.29048	Hesthagen & Gunnerød 1981
Norway	32712	Kaldfjorden	Nord-Fron	Innlandet	1 019	19.178	350	5.9			Bt,Wf,Em	-	61.36683	9.18567	T. Løkensgard, pers. comm.
Norway	30518	Fisketjerni	Øystre Slidre	Innlandet	1 329	0.433	550				Bt	+	61.37490	8.84221	T. Hesthagen, pers. comm.
Norway	32699	Blåtjernet	Øystre Slidre	Innlandet	1 450	0.070	450				Bt	+	61.38522	8.94130	artsdatabanken.no
Norway	30499	Fisketjerni	Øystre Slidre	Innlandet	1 377	0.180	550				Bt	+	61.39347	8.79028	T. Hesthagen, pers. comm.
Norway	30490	Fisketjerni	Øystre Slidre	Innlandet	1 373	0.134	550				Bt	+	61.39469	8.79076	T. Hesthagen, pers. comm.
Norway	30496	Fisketjerni	Øystre Slidre	Innlandet	1 378	0.051	550				Bt	+	61.39739	8.79054	T. Hesthagen, pers. comm.
Norway	32705	Fisketjerni	Øystre Slidre	Innlandet	1 330	0.103	550				Bt	+	61.39840	8.80113	T. Hesthagen, pers. comm.
Norway	30491	Fisketjerni	Øystre Slidre	Innlandet	1 379	0.044	550				Bt	+	61.40038	8.78835	T. Hesthagen, pers. comm.
Norway	212	Øyangen	Nord-Fron	Innlandet	998	4.219	314	2.0			Bt,Em	-	61.41477	9.24200	Aass 1969
Norway	272	Øvre Heimdalsvatnet	Øystre Slidre	Innlandet	1 088	0.779	571			13.0	Bt,Em	0	61.42244	8.86754	Lien 1978
Norway	30459	Grisletjønnen	Lom	Innlandet	1 384	0.354	300				Bt	+	61.42613	8.39613	T. Hesthagen, pers. comm.
Norway	211	Nedre Heimdalsvatn	Vågå	Innlandet	1 052	7.244	550	2.2			Bt,Em	0	61.43135	8.99860	Aass 1969
Norway	30446	Grisletjønnen	Lom	Innlandet	1 362	0.393	768				Bt	+	61.44099	8.40930	T. Hesthagen, pers. comm.
Norway	32588	Brurskardtjern	Vågå	Innlandet	1 309	0.236	550				Bt	+	61.45212	8.84222	Sømme S 1934
Norway	80624	Trygvetjønn	Lom	Innlandet	1 397	0.013	750				Bt	+	61.48118	8.54525	T. Hesthagen, pers. comm.
Norway	32527	Skåltjørna	Nord-Fron	Innlandet	1 348	0.631	450				Bt,Em	+	61.50319	9.00229	Huitfeldt-Kaas 1916
Norway	220	Øvre Sjodalsvatnet	Vågå	Innlandet	954	4.776	700				Bt,Em	-	61.52634	8.89042	T. Løkensgard, pers. comm.
Norway	218	Russvatnet	Vågå	Innlandet	1 175	4.622	723				Bt, Em	+	61.53989	8.66088	T. Løkensgard, pers. comm.
Norway	32333	Sylvetjørni	Lom	Innlandet	1 403	0.464	456				Bt,Em	+	61.76723	8.89288	T. Hesthagen, pers. comm.

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	277	Honnsjøen	Lom	Innlandet	1 093	1.546	300				Bt	+	61.90152	8.56221	T. Løkensgard, pers. comm.
Norway	222	Aursjoen	Skjåk	Innlandet	1 098	7.385	260	12.4			Bt	+	61.93794	8.27104	Aass 1969
Norway	30243	Aursjotjønne	Skjåk	Innlandet	1 100	0.138	260				Bt	+	61.94456	8.21407	artsdatabanken.no
Norway	275	Råkåvatnet	Lom	Innlandet	1 364	1.501	311				Bt	+	61.95432	8.55991	T. Hesthagen, pers. comm.
Norway	29118	Huguvardtjønne	Skjåk	Innlandet	1 276	0.467	544				Bt	+	61.96452	7.69078	R. Bøje, pers. comm.
Norway	30240	Aukarsvatnet	Skjåk	Innlandet	1 285	0.685	260				Bt	+	61.96677	8.25936	T. Hesthagen, pers. comm.
Norway	276	Leirungsvatn	Skjåk	Innlandet	1 370	2.570	311				Bt	+	61.97226	8.50190	T. Hesthagen, pers. comm.
Norway	30230	NN	Skjåk	Innlandet	1 371	0.050	300				Bt	+	61.97852	8.46636	artsdatabanken.no
Norway	30223	Utletjørnin	Skjåk	Innlandet	1 360	0.215	300				Bt	+	61.98218	8.43863	B. Wegge, pers.comm.
Norway	29086	Heillstuguvatnet	Skjåk	Innlandet	1 000	0.812	759				Bt	+	61.98384	7.59773	T. Løkensgard, pers. comm.
Norway	30220	Meborotjønne	Skjåk	Innlandet	1 346	0.156	300				Bt	+	61.98534	8.28730	T. Hesthagen, pers. comm.
Norway	30218	Lortjørnin	Skjåk	Innlandet	1 315	0.099	300				Bt	+	61.98559	8.15652	T. Hesthagen, pers. comm.
Norway	30219	Lortjørnin	Skjåk	Innlandet	1 315	0.052	300				Bt	+	61.98725	8.15267	T. Hesthagen, pers. comm.
Norway	29081	Stamåtjønnin	Skjåk	Innlandet	1 322	0.156	300				Bt	+	61.99424	8.03789	T. Hesthagen, pers. comm.
Norway	29079	Småtjørnin	Skjåk	Innlandet	1 325	0.160	300				Bt	+	61.99481	8.06412	artsdatabanken.no
Norway	30210	NN nord for Stortjønne	Skjåk	Innlandet	1 312	0.223	300				Bt	+	61.99949	8.16066	artsdatabanken.no
Norway	32111	NN 1 km øst for Lorttjønnin	Skjåk	Innlandet	1 361	0.123	300				Bt	+	62.00422	8.19747	T. Hesthagen, pers. comm.
Norway	32108	Grotlivatnet	Skjåk	Innlandet	863	0.666	750				Bt	-	62.00528	7.66611	T. Hesthagen, pers. comm.
Norway	32109	Kvennåtjørna	Skjåk	Innlandet	1 369	0.155	300				Bt	+	62.00707	8.00227	K. Gløverstad, pers. comm.
Norway	34836	Fellingvatnet	Lesja	Innlandet	1 269	0.455	332				Bt	+	62.01030	8.34980	O. Heitkøtter, pers. comm.
Norway	151	Breidalsvatnet	Skjåk	Innlandet	900	6.899	800	13.0			Bt	0	62.01638	7.57787	Aass 1969
Norway	34811	Rygghøtjønne	Lesja	Innlandet	1 524	0.227	351				Bt	+	62.03672	8.57253	O. Heitkøtter, pers. comm.

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	1964	Heimste Viavatnet	Norddal	Møre og Romsdal	1 001	1.597	1121	36.5			Bt	+	62.09713	7.41148	artsdatabanken.no
Norway	34779	Gravåtjønne	Lesja	Innlandet	1 257	0.035	300				Bt	+	62.12971	8.49540	O. Heitkøtter, pers. comm.
Norway	208	Torsvatnet	Skjåk	Innlandet	1 336	6.286	1140				Bt	+	62.13986	7.82726	T. Løkensgard, pers. comm.
Norway	34761	Valåvatnet	Lesja	Innlandet	1 281	0.411	300				Bt	+	62.14516	8.46936	O. Heitkøtter, pers. comm.
Norway	34758	Haukskardtjørni	Dovre	Innlandet	1 089	0.226	300				Bt	+	62.15040	9.40293	J. Hageland, pers. comm.
Norway	34748	Fillingstjønne	Lesja	Innlandet	1 393	0.504	243				Bt	+	62.18308	8.80579	O. Heitkøtter, pers. comm.
Norway	34749	Horrungtjørnin	Lesja	Innlandet	1 436	0.025	350				Bt	+	62.18474	8.78909	O. Heitkøtter, pers. comm.
Norway	34744	Horrungtjørnin	Lesja	Innlandet	1 432	0.145	350				Bt	+	62.18996	8.78460	O. Heitkøtter, pers. comm.
Norway	34741	Kvittjørnin	Lesja	Innlandet	1 360	0.270	400				Bt	+	62.19335	8.76307	O. Heitkøtter, pers. comm.
Norway	34723	Veslstrålsjøen	Lesja	Innlandet	1 296	0.199	450				Bt	+	62.20490	9.07723	O. Heitkøtter, pers. comm.
Norway	233	Mjogsjøen	Lesja	Innlandet	1 234	0.972	479				Bt	+	62.22598	9.06147	O. Heitkøtter, pers. comm.
Norway	34701	Einøvlingsvatnet	Dovre	Innlandet	1 383	0.476	300				Bt,Ac	+	62.24323	9.34343	J. Hageland, pers. comm.
Norway	1995	Aursjøen	Lesja	Innlandet	856	36.757	400	28.0			Bt,G,Em	0	62.24533	8.80044	Aass 1969
Norway	170	Savalen	Alvdal	Innlandet	708	15.291	180	4.7			Bt,Ac,G,Em	-	62.24618	10.48208	Hansen & Stubsjøen 1984
Norway	1987	Ulvådalsvatnet	Rauma	Møre og Romsdal	857	2.142	1068				Bt	-	62.26058	7.84141	Arnekleiv & Koksvik 1985
Norway	34671	Lesjøen	Lesja	Innlandet	1 182	0.481	450				Bt	+	62.27216	9.04120	A. Bretten, pers. comm.
Norway	34660	Svartdalsvatnet	Lesja	Innlandet	1 018	0.592	500				Bt	+	62.27786	8.84411	Aass 1969
Norway	1998	Vangsvatnet	Lesja	Innlandet	1 166	2.551	522				Bt,G	+	62.30693	8.54578	O. Heitkøtter, pers. comm.
Norway	34630	Langvasstjørni	Lesja	Innlandet	1 409	0.083	400				Bt	+	62.30754	9.12093	O. Heitkøtter, pers. comm.
Norway	34635	Langvasstjørni	Lesja	Innlandet	1 406	0.168	750				Bt	+	62.30754	9.12093	O. Heitkøtter, pers. comm.

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	234	Langvatnet	Lesja	Innlandet	1 411	1.316	784				Bt	+	62.32078	9.16139	P. Jordhøy, pers. comm.
Norway	34580	Miutjørni	Lesja	Innlandet	1 265	0.120	550				Bt	+	62.32920	8.45145	Ø. Malmen, pers. comm.
Norway	34583	Miutjørni	Lesja	Innlandet	1 263	0.053	550				Bt	+	62.32951	8.45160	Ø. Malmen, pers. comm.
Norway	34564	Langvatn, tjern N for	Lesja	Innlandet	1 416	0.135	750				Bt	+	62.33332	9.17805	P. Aass, pers. comm.
Norway	34558	Drugshøtjørnin	Lesja	Innlandet	1 361	0.192	400				Bt	+	62.33730	9.12041	Korsen & Gjøvik 1977
Norway	34573	Drugshøtjørnin	Lesja	Innlandet	1 367	0.045	400				Bt	+	62.33730	9.12041	T. Hesthagen, pers. comm.
Norway	34574	Drugshøtjørnin	Lesja	Innlandet	1 367	0.097	400				Bt	+	62.33730	9.12041	T. Hesthagen, pers. comm.
Norway	1229	Kaldvellsjøen	Oppdal	Trøndelag	1 229	0.248	400				Bt	+	62.34013	9.52667	S. Bretten, pers. comm.
Norway	34511	Åmotsvatnet	Oppdal	Trøndelag	1 301	0.971	882				Bt	+	62.35802	9.18165	Korsen & Gjøvik 1977
Norway	34499	Skjellbreidvatnet	Lesja	Innlandet	924	0.166	600				Bt,Em	+	62.36805	8.67844	Aass 1969
Norway	244	Elgsjøen	Oppdal	Trøndelag	1 132	2.385	180	5.4			Bt	+	62.37359	9.78697	Aass 1969
Norway	34412	Fundin	Folldal	Innlandet	1 022	10.400	184				Bt,G,Em	+	62.39213	9.89664	Enerud 1981
Norway	34371	Lertjønna	Oppdal	Trøndelag	1 315	0.303	180				Bt,Em	+	62.45672	9.78552	Klausen 2012
Norway	2114	Osbuvatnet	Sunndal	Møre og Romsdal	849	9.720	750	31.0			Bt,G	+	62.48298	8.52675	Aass 1969
Norway	34306	Snøfjelltjønna	Oppdal	Trøndelag	1 120	0.592	571				Bt	+	62.50274	9.33583	Nøst 1981
Norway	34315	Orkelsjøen	Oppdal	Trøndelag	1 058	2.023	180				Bt,Em	+	62.50730	9.87373	R. Pettersen, pers. comm.
Norway	2113	Holbuvatn	Sunndal	Møre og Romsdal	793	0.818	800	15.7			Bt,G	+	62.51664	8.47063	Fylkesmannen i Møre og Romsdal
Norway	2112	Reinsvatn	Sunndal	Møre og Romsdal	892	3.872	879	17.6			Bt,Em	+	62.54696	8.39180	Aass 1969
Norway	960	Stor-Svergjesjøen	Tynset	Innlandet	873	1.643	336	4.8			Bt	+	62.62878	10.32795	Own data
Norway	114	Aursunden	Røros	Trøndelag	691	46.402	500	5.9			Bt,Ac,Wf,P, G,B,Em	-	62.66631	11.65947	J.I. Koksvik, pers. comm.
Norway	35279	Fjellsjøen	Tynset	Innlandet	973	0.568	577				Bt	+	62.68525	10.89863	Fylkesmannen i Hedmark
Norway	876	Forolsjøen	Holtålen	Trøndelag	992	3.782	596				Bt	+	62.68525	10.81659	Koksvik & Nøst 1981
Norway	887	Stor-Hiåsjøen	Midtre Gauldal	Trøndelag	927	1.323	500				Bt	+	62.70445	10.39357	Koksvik & Nøst 1981
Sweden		Nameless	Berg	Jämtland	1273	0.015	500					+	62.82727	12.18512	bioatlas.se

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Sweden	6996099-1340988	Nameless	Berg	Jämtland	1275	0.003	500				Ac	+	62.82736	12.18880	I. Näslund, pers. comm.
Norway	130	Riasten	Holtålen	Trøndelag	805	5.075	500				Bt,Ac,Em	-	62.84719	11.76110	A. Langeland, pers. comm.
Norway	34974	Rotåsjøen	Tydal	Trøndelag	1 100	0.168	544				Bt	+	62.86641	12.01373	R. Pettersen, pers. comm.
Norway	34941	Skarddørstjønnane	Tydal	Trøndelag	1 062	0.935	526				Bt,Ac	+	62.87082	12.08184	artsdatabanken.no
Norway	38540	Elgesjøen	Tydal	Trøndelag	860	0.461	494	5.4			Bt,Ac	+	63.05541	11.88371	artsdatabanken.no
Sweden	702679-133966	Ånnsjön	Åre	Jämtland	525	57.433	500				Bt,Ac,Abt,Lt	-	63.27284	12.52776	Ekman 1922
Norway	736	Skurdalsjøen	Meråker	Trøndelag	694	0.150	507	6.5			Bt,Em	+	63.36275	12.10586	Arnekleiv 1985
Norway	737	Fjergen	Meråker	Trøndelag	514	16.343	585	16.0	10.0	26.9	Bt,Ac	-	63.45611	11.97135	Koksvik & Arnekleiv 2001
Sweden	705440-132428	Skalsvattnet	Åre	Jämtland	555	10.791	500				Bt,Ac	-	63.56845	12.21283	Nilsson 1963
Sweden	708347-138723	Korsvattnet	Krokom	Jämtland	745	12.078	500	6.0		92.0	Ac	+	63.87343	13.52566	Runnström & Määr 1950
Sweden	707659-136489	Torrön	Åre	Jämtland	417	103.012	500	12.0		116.0	Bt,Ac,B	-	63.89899	12.96140	Runnström & Määr 1950
Norway	40093	Holmvatnet	Lierne	Trøndelag	723	0.484	494				Bt,Ac	-	64.39768	14.07847	artsdatabanken.no
Norway	39719	Gaajsjaevrie	Røyrvik	Trøndelag	651	1.354	500				Bt	+	64.54963	13.11893	Arnekleiv & Haug 1995
Norway	39654	Øvre Nesåvatnet	Namsskogan	Trøndelag	577	1.205	550				Bt,Ac	0	64.56716	13.08355	Arnekleiv & Haug 1995
Norway	39672	Midtre Nesåvatnet	Namsskogan	Trøndelag	506	0.585	550				Bt,Ac	0	64.56773	12.99420	Nøst & Koksvik 1980
Norway	39637	Nedre Nesåvatnet	Grong	Trøndelag	427	1.026	572				Bt	0	64.57221	12.91463	Nøst & Koksvik 1980
Norway	39569	Nesåflyan	Røyrvik	Trøndelag	706	0.253	550				Bt	+	64.59472	13.12150	Arnekleiv & Haug 1995
Norway	714	Gruvvatnet	Namsskogan	Trøndelag	722	1.358	550				Bt	+	64.60804	13.10881	Arnekleiv & Haug 1995
Sweden	717805-142346	Stor-Blåsjön	Strömsund	Jämtland	433	40.300	500	14.0	43.1	144.0	Bt,Ac,Em	-	64.79734	14.15284	Runnström & Määr 1950
Norway	1131	Limingen	Røyrvik	Trøndelag	418	93.271	650	8.7			Bt,Ac,Em	-	64.82308	13.54797	Aass 1969
Sweden	719338-142567	Ankarvatnet	Strömsund	Jämtland	449	9.348	500		26.4	75.0	Bt,Ac	-	64.85802	14.22714	J. Hammar, pers. comm.
Norway	1124	Hudningsvatnet	Røyrvik	Trøndelag	464	6.634	650				Bt,Ac,Em	-	64.87705	13.78535	Sivertsen 1973
Norway	1123	Vektaren	Røyrvik	Trøndelag	446	8.796	660	5.5			Bt,Ac,Em	-	64.91969	13.52769	R. Pettersen, pers. comm.

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Sweden	720202-142425	Leipikvattnet	Strömsund	Jämtland	469	5.062	500			24.8	Bt,Ac	-	64.92821	14.18691	Runnström & Määr 1950
Sweden	720825-145723	Autjojaure	Vilhelmina	Västerbotten	898	2.066	500					+	64.97516	14.89913	bioatlas.se
Sweden	421257-144586	Skiermotjåltetjärn	Vilhelmina	Västerbotten	915	0.017	500			2.7	Ac	+	65.01224	14.65672	Fängstam 1999a
Norway	698	Namsvatnet	Røyrvik	Trøndelag	454	39.441	650	14.0			Bt,Ac	-	65.01306	13.75921	Sivertsen 1962
Sweden	7214556-1439723	Daimaplatån	Strömsund	Jämtland	917	0.003	500			>1	Fishless	+	65.02900	14.52575	Bergström 2003
Norway	1122	Sipmeken, Østre	Røyrvik	Trøndelag	668	2.519	625				Bt	+	65.03146	14.19188	E. Sivertsen, pers. comm.
Sweden	721490-144511	Njereujaure	Vilhelmina	Västerbotten	860	0.615	500			11.3	Ac	+	65.03302	14.63991	Fängstam 1998
Sweden	7223886-1431566	Nameless	Strömsund	Jämtland	955	0.005	500			0.8	Fishless	+	65.04543	14.27349	Bergström 2003
Norway	719	Vestre Rækarvatnet	Røyrvik	Trøndelag	572	2.753	852				Bt	-	65.05510	13.62302	E. Sivertsen, pers. comm.
Norway	43607	Sipmeken, Vestre	Røyrvik	Trøndelag	699	0.968	625				Bt	+	65.06096	14.15187	E. Sivertsen, pers. comm.
Norway	43785	Djupvatnet	Røyrvik	Trøndelag	600	1.287	800				Bt	-	65.06619	13.72944	Berg 1954
Sweden	721938-143918	Tjallingenjaure	Vilhelmina	Västerbotten	921	0.245	500				Fishless	+	65.07506	14.51667	Lingdell & Engblom 1990
Norway	43789	Blyvatnet	Røyrvik	Trøndelag	643	1.469	800				Bt	+	65.09215	13.68503	Berg 1954
Norway	43784	Jengelskardvatn	Namsskogan	Trøndelag	653	1.346	950				Bt	+	65.10261	13.58090	Namsskogan fjellstyre
Norway	43480	Saapmanjaevrie	Røyrvik	Trøndelag	944	0.291	800				Bt	+	65.10761	13.99770	H.M.Berger, pers. comm.
Sweden	7216653-1427882	Nameless	Vilhelmina	Västerbotten	930	0.000	500			0.5	Fishless	+	65.11107	14.34814	Bergström 2003
Norway	700	Jengelen	Grane	Nordland	652	2.491	800				Bt	+	65.11759	13.65634	Berg 1954
Norway	43394	Kyllingen	Grane	Nordland	770	0.060	800				Bt	+	65.13653	13.67144	Berg 1954
Norway	43378	Lille Kjukkelvatnet	Hattfjelldal	Nordland	683	0.851	800				Bt	+	65.13910	13.75857	Berg 1954
Norway	43376	Orrekvatnet	Grane	Nordland	601	0.368	1104				Bt	+	65.13951	13.58307	Berg 1954
Norway	442	Øvre Kalvvatnet	Bindal	Nordland	519	6.485	1643	35.0		19.0	Bt	+	65.15124	12.99598	Jensen 1973
Norway	43286	Vajavatnet	Grane	Nordland	913	0.586	900				Bt	+	65.16711	13.70127	Berg 1954
Sweden	723054-143323	Drielleken	Vilhelmina	Västerbotten	907	0.171	500				Bt	+	65.17107	14.38035	bioatlas.se
Norway	701	Store Kjukkelvatnet	Hattfjelldal	Nordland	816	2.868	757				Bt	+	65.18402	13.89049	Berg 1954
Norway	1119	Rantseren	Hattfjelldal	Nordland	803	2.693	550				Bt	+	65.18822	14.32593	Koksvik 1976
Norway	43216	Søre Biseggvatnet	Grane	Nordland	777	1.035	1096				Bt	+	65.18976	13.74472	Berg 1954

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	43161	Rundvatn	Bindal	Nordland	534	1.114	1643			28.0	Bt	+	65.20442	13.02731	Jensen 1974
Norway	43142	Rotnan	Hattfjelldal	Trøndelag	960	0.549	565				Bt	+	65.22179	14.23243	Koksvik 1976
Norway	43117	Nordre Biseggvatnet	Grane	Nordland	858	0.940	1096				Bt	+	65.22261	13.72370	Berg 1954
Norway	43073	Vestre Måsskardvatnet	Grane	Nordland	882	0.301	1000				Bt	+	65.25108	13.76377	Berg 1954
Norway	43062	Austre Måsskardvatnet	Grane	Nordland	911	0.910	750				Bt	+	65.25499	13.84192	Berg 1954
Norway	43047	Simskarvatn, tjern like S for	Hattfjelldal	Nordland	1 009	0.145	950				Bt	+	65.26870	13.82460	Berg 1954
Norway	472	Vestre Tiplingen	Hattfjelldal	Nordland	672	1.835	700				Bt	0	65.27505	14.08067	Berg 1954
Norway	473	Simskardvatnet	Hattfjelldal	Nordland	877	3.470	977				Bt	+	65.28309	13.82874	Berg 1954
Norway	42979	Legdvatnet	Hattfjelldal	Nordland	817	0.181	700				Bt	+	65.31739	13.97052	Berg 1954
Norway	483	Nedre Fiplingvatn	Grane	Nordland	364	10.609	1037				Bt	-	65.35059	13.58602	Koksvik 1976
Norway	42916	Breiskardvatn	Hattfjelldal	Trøndelag	864	0.358	904				Bt	+	65.35831	13.49769	Koksvik 1976
Norway	487	Daningen	Hattfjelldal	Nordland	749	3.729	454				Bt	0	65.35920	14.41610	Berg 1954
Norway	42871	Fiskelausvatnet	Hattfjelldal	Nordland	760	1.029	500				Bt	+	65.38798	14.33480	Koksvik 1976
Sweden	726792-144724	Arevattnet	Storuman	Västerbotten	672	6.687	500		13.9	42.5	Bt	+	65.50880	14.66474	Hedlund 2000
Sweden	726920-144498	Naireken 3	Storuman	Västerbotten	881	0.173	500			7.0	Fishless	+	65.52229	14.60835	Fängstam 1999b
Sweden	726941-144439	Naireken 4	Storuman	Västerbotten	881	0.049	500			7.0	Fishless	+	65.52233	14.60110	Fängstam 1999b
Sweden	727147-146213	Abelvattnet	Storuman	Västerbotten	663	32.622	500	16.0	19.1	61.3	Bt	+	65.52351	14.76339	Nilsson 1963
Sweden	727017-144494	Naireken 5	Storuman	Västerbotten	891	0.071	500			16.2	Bt	+	65.52859	14.61413	Fängstam 1999b
Sweden	727050-144423	Naireken 1	Storuman	Västerbotten	902	0.026	500			7.0	Bt	+	65.53143	14.59864	Fängstam 1999b
Sweden	727061-144396	Naireken 2	Storuman	Västerbotten	887	0.040	500			7.0	Bt	+	65.53237	14.59276	Fängstam 1999b
Sweden	727091-144383	Naireken 6	Storuman	Västerbotten	878	0.033	500			7.0	Bt	+	65.53503	14.58982	Fängstam 1999b
Sweden	727153-144378	Naireken 7	Storuman	Västerbotten	877	0.061	500			2.9	Bt	+	65.54058	14.58848	Fängstam 1999b
Sweden	727260-144427	Nuolejukketjärnen	Storuman	Västerbotten	781	0.080	500			7.0	Bt	+	65.55026	14.59864	Fängstam 1999b
Norway	467	Elsvatnet	Hattfjelldal	Nordland	481	2.168	533				Bt	-	65.57329	14.16976	artsdatabanken.no
Norway	42598	Midtre Penkelvatn	Hattfjelldal	Trøndelag	786	0.170	500				Bt,Ac	+	65.60165	14.39257	Koksvik 1976
Norway	42592	Kjerringvatn	Hattfjelldal	Trøndelag	675	0.784	500				Bt,Ac	+	65.60279	14.28889	Koksvik 1976
Norway	42577	Måsvatn	Hattfjelldal	Trøndelag	825	0.572	500				Bt,Ac	+	65.60831	14.46178	Koksvik 1976
Sweden	727529-147653	Stor-Björkvattnet	Storuman	Västerbotten	392	25.900	400	6.0	30.2	65.5	Bt,Ac,Wf	-	65.61116	15.21577	Nilsson & Filipsson 1971
Sweden	727964-144597	Gapsjaure	Storuman	Västerbotten	916	0.235	400			24.0	Ac	+	65.61465	14.63804	Fängstam 1999a
Sweden	727981-146325	Guoutejaure	Storuman	Västerbotten	840	0.809	400					+	65.61763	15.00741	bioatlas.se

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Sweden	728018-146353	Annarn	Storuman	Västerbotten	840	0.366	400					+	65.62098	15.01338	bioatlas.se
Sweden	728108-145089	Guoutelesjaure	Storuman	Västerbotten	1038	0.414	400					+	65.62737	14.73878	bioatlas.se
Sweden	728245-146322	Nameless	Storuman	Västerbotten	861	0.117	400					+	65.64130	15.00603	bioatlas.se
Sweden	728245-146322	Skiträsktjärn	Storuman	Västerbotten	861	0.117	400			14.3	Ac	+	65.64268	15.00958	bioatlas.se
Norway	42512	Vågvatnet	Hattfjelldal	Nordland	695	0.754	600				Bt,Em	+	65.64823	14.25131	Koksvik 1976
Norway	508	Brundreinvatnet	Hattfjelldal	Nordland	768	1.225	442				Bt	+	65.65169	14.44471	Koksvik 1976
Norway	507	Austerkrutvatnet	Hattfjelldal	Nordland	592	1.860	400				Bt	-	65.68052	14.51798	Berg 1954
Norway	42390	Bukksvatnet	Hattfjelldal	Nordland	622	1.424	452				Bt	-	65.71705	14.49445	Koksvik 1976
Norway	42348	Fiskelausvatnet	Hattfjelldal	Nordland	709	s	450				Bt	+	65.74689	14.42171	Koksvik 1976
Norway	501	Røssvatnet	Hattfjelldal	Nordland	383	218.049	721	11.3			Bt,Ac,Em	-	65.76978	14.07465	Berg 1954
Sweden	729792-145421	Baktejaure	Storuman	Västerbotten	725	0.043	500				Ac	+	65.77801	14.80810	M. Hedlund, pers. comm.
Sweden	729859-145408	Guoblejaure	Storuman	Västerbotten	716	0.081	500				Ac	+	65.78388	14.79994	M. Hedlund, pers. comm.
Sweden	730366-145885	Tängvattnet	Storuman	Västerbotten	472	14.418	500		25.0	53.5	Bt,Ac	-	65.83263	14.80580	M. Hedlund, pers. comm.
Norway	42185	Øvre Skinnfjellvatnet	Hattfjelldal	Nordland	663	0.364	568				Bt	+	65.83580	14.48600	Koksvik 1976
Sweden	731205-151045	Äivisjauratje	Sorsele	Västerbotten	1101	0.151	400					+	65.91181	16.03835	bioatlas.se
Sweden	731799-151196	Stor-Tjulträsket	Sorsele	Västerbotten	538	5.247	400		21.2	38.0	Ac	-	65.96191	16.06788	M. Hedlund, pers. comm.
Sweden	731740-146435	Överuman	Storuman	Västerbotten	523	84.470	500	5.0	20.5	78.8	Bt,Ac	-	66.00956	15.02491	Hammar 1978
Sweden	733117-146211	Brandsvattentjärnen	Storuman	Västerbotten	857	0.067	500					+	66.07820	14.97817	bioatlas.se
Norway	511	Stormålvatnet	Hemnes	Nordland	430	7.355	1126	33.0			Bt,Ac	-	66.10448	14.08928	artsdatabanken.no
Sweden	733708-148809	Ammerjaure	Sorsele	Västerbotten	696	0.869	500			5.0	Bt,Ac	+	66.13310	15.54118	Gydemo 1979
Norway	45359	Storakersvatnet	Rana	Nordland	523	42.242	925	43.0			Bt,Ac	-	66.16502	14.38920	Berg 1954
Norway	45358	Kallvatnet	Rana	Nordland	564	28.612	586	43.0			Bt,Ac	-	66.23629	14.92850	artsdatabanken.no
Sweden	735958-149900	Sarvesjaure	Arjeplog	Norrbotten	924	0.275	500		3.0	8.5	Ac	+	66.33811	15.79170	Karlsson 1971
Sweden	735983-150366	Vuordnajaure	Arjeplog	Norrbotten	923	1.151	500			30.0	Ac	+	66.33830	15.84780	Karlsson 1971
Norway	44715	Jordbekkvatnan	Rana	Nordland	645	0.831	630				Bt,Ac	+	66.40824	15.10366	artsdatabanken.no
Norway	758	Svartisvatnet	Rana	Nordland	74	2.216	1289				Bt	-	66.49317	14.19568	Hvidsten & Johnsen 1976
Sweden	737863-148969	Verdejaure	Arjeplog	Norrbotten	866	0.675	500		3.5	10.0	Bt,Ac	+	66.51437	15.57203	Karlsson 1972
Sweden	739326-151140	Nameless	Arjeplog	Norrbotten	1004	0.160	500		2.5	5.8	Bt	+	66.64181	16.05530	Karlsson 1972
Sweden	739636-150912	Gärrimjaure	Arjeplog	Norrbotten	1022	0.332	500		5.0	17.0	Ac	+	66.66727	15.99285	Karlsson 1972

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	778	Storglomvatnet	Meløy	Nordland	585	47.302	1806	125.0			Bt	+	66.70884	14.13947	Hvidsten & Johnsen 1976
Sweden	740325-150897	Kuoletisjaure	Arjeplog	Norrbotten	709	1.287	500		7.0	14.5	Ac	+	66.73605	15.98899	Karlsson 1972
Norway	747	Søre Bjøllåvatnet	Rana	Nordland	633	2.916	650				Bt,Ac	+	66.73830	15.03289	Hvidsten & Johnsen 1976
Norway	44047	Daudmannsvatnet	Gildeskål	Nordland	445	0.212	1700				Bt	0	66.87776	14.17351	Berg 1954
Norway	796	Storvatnet	Gildeskål	Nordland	188	3.295	1700	10.0			Bt	-	66.88504	14.09698	Berg 1954
Sweden	742442-155342	Nedre Sartajaure	Arjeplog	Norrbotten	737	0.724	550		4.0	13.8	Bt,Ac	+	66.91920	17.01444	Karlsson 1972
Sweden	742622-155222	Sartaure	Arjeplog	Norrbotten	744	1.743	550		3.0	12.0	Bt,Ac	+	66.93870	16.99620	Karlsson 1972
Sweden	742346-154508	Pieskehaure	Arjeplog	Norrbotten	577	58.759	550	2.0			Ac	+	66.96442	16.56173	Fürst 1981
Sweden	743228-156668	Tarraure	Jokkmokk	Norrbotten	503	2.041	500				Ac	-	66.98626	17.28946	Nilsson 1965
Norway	813	Balvatnet (Coar'visivvum)	Saltdal	Nordland	597	40.839	653	7.4			Bt	+	66.98751	15.95467	artsdatabanken.no
Norway	46660	Såki	Fauske	Nordland	514	0.315	693				Bt	-	67.05944	15.98947	Berg 1954
Sweden	744801-157718	Tjeurajaure	Jokkmokk	Norrbotten	1033	0.175	500				Fishless	+	67.11925	17.57855	Eidfjord fjellstyre
Sweden	745326-155680	Tarraluoppal	Jokkmokk	Norrbotten	691	0.295	500				Ac	+	67.18031	17.12205	Ola Nutt, pers. comm.
Sweden	746089-160304	Ábbmojávrre	Jokkmokk	Norrbotten	1019	0.265	500					+	67.22890	18.17943	Ekman 1904
Sweden	746116-157292	Luottojaure	Jokkmokk	Norrbotten	1193	0.182	500					+	67.23524	17.48327	Ekman 1904
Sweden	746115-153824	Jållelako J14	Jokkmokk	Norrbotten	905	0.004	500			>2	Fishless	+	67.24345	16.69034	Blomkvist 1995
Sweden	746115-153824	Jållelako J15	Jokkmokk	Norrbotten	907	0.005	500			>2	Fishless	+	67.24372	16.68984	Blomkvist 1995
Sweden	745980-152900	Jållelako J32	Jokkmokk	Norrbotten	902	0.004	500			>2	Fishless	+	67.24372	16.68970	Blomkvist 1995
Sweden	746334-155401	Tuottarjaure	Jokkmokk	Norrbotten	893	1.299	500			42.5	Ac	+	67.27661	17.05488	J. Hammar, pers. comm.
Sweden	750191-154148	Apmeljaure	Jokkmokk	Norrbotten	682	0.847	500			13.9	Ac	+	67.61138	16.80455	J. Hammar, pers. comm.
Sweden	750740-160638	Teusajaure	Gällivare	Norrbotten	497	10.866	500		25.0	71.0	Bt,Ac	-	67.68857	18.15775	M. Hedlund, pers. comm.
Sweden	751500-161330	Livamjaure	Gällivare	Norrbotten	779	1.409	500		12.0	33.5	Bt	+	67.69935	18.43523	Karlsson 1972
Sweden	751848-158585	Suorkejaure	Gällivare	Norrbotten	550	2.500	500		22.0	47.0	Bt,Ac	-	67.75428	17.78454	M. Hedlund, pers. comm.
Sweden	752066-157996	Autajaure	Gällivare	Norrbotten	581	10.253	500		13.0	47.0	Ac	-	67.79812	17.64762	M. Hedlund, pers. comm.
Norway	45693	Rombovatn Øvre	Tysfjord	Nordland	458	1.155	999				Bt	+	67.80231	16.30690	Koksvik & Dalen 1980
Norway	45677	Rombovatn Midtre	Tysfjord	Nordland	457	0.243	999				Bt	+	67.81497	16.29337	Koksvik & Dalen 1980

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Sweden	752642-161197	Nedre Liddojaure	Gällivare	Norrbotten	850	0.299	600		3.0	5.5	Bt,Ns	+	67.81577	18.44905	Karlsson 1972
Norway	45636	Rombovatn Nedre	Tysfjord	Nordland	456	0.911	999				Bt	+	67.82667	16.28927	Koksvik & Dalen 1980
Sweden	753365-155121	Tjålmejaure	Gällivare	Norrbotten	641	0.516	600				Ac	+	67.88791	17.03198	bioatlas.se
Sweden	753386-155022	Lill Tjålmejaure	Gällivare	Norrbotten	637	0.157	600				Ac	+	67.89299	17.00953	bioatlas.se
Sweden	753473-158387	Littejaure	Gällivare	Norrbotten	797	0.902	600		2.0	7.0	Ac	+	67.89852	17.81941	Karlsson 1972
Sweden	753530-154721	Svartiluoppal	Gällivare	Norrbotten	541	0.643	600				Ac	+	67.90746	16.93222	bioatlas.se
Sweden	754002-154714	Svartijaure	Gällivare	Norrbotten	692	0.748	600					+	67.95030	16.92943	bioatlas.se
Sweden	753060-157680	Sitasjaure	Gällivare	Norrbotten	612	73.145	600	10.0			Ac	+	67.97220	17.52694	Karlsson 1972
Norway	49072	Vannaksvatn	Narvik	Nordland	858	17.318	636	33.0			Bt,Ac	+	67.98280	17.88882	artsdatabanken.no
Norway	1024	Cunojávri	Narvik	Nordland	702	1.311	571				Bt,Ac	+	68.19949	18.10971	artsdatabanken.no
Sweden	758208-161749	Abiskojaure	Kiruna	Norrbotten	487	2.791	600		11.0	35.0	Ac	-	68.29745	18.61894	Ekman 1904
Sweden	758522-161441	Vuolemus Kårsavaggejaure	Kiruna	Norrbotten	665	0.713	600				Ac	+	68.33442	18.51034	Ekman 1904
Sweden	760404-163031	Kåivujaure	Kiruna	Norrbotten	842	2.032	600				Fishless	+	68.49551	18.99532	bioatlas.se
Sweden	760390-162810	Sjö 797	Kiruna	Norrbotten	796	0.245	600				Fishless	+	68.49593	18.93376	bioatlas.se
Sweden	7604274-1630092	Nameless	Kiruna	Norrbotten	846	0.007	600				Fishless	+	68.49902	18.98418	bioatlas.se
Norway	49381	Vuolimus Guolazjavri	Bardu	Troms og Finmark	832	0.353	650				Bt	+	68.63159	19.31871	Fylkesmannen i Troms
Norway	49378	Gaskkamus Guolazjavri	Bardu	Troms og Finmark	842	0.138	650				Bt,G	+	68.63648	19.30542	artsdatabanken.no
Norway	50015	Golggotjavri	Målselv	Troms og Finmark	759	0.063	500				Bt,Ac,B	+	68.65708	20.15601	Fylkesmannen i Troms
Norway	50013	Ukjent	Målselv	Troms og Finmark	760	0.048	500				Bt,Ac	+	68.65972	20.14562	artsdatabanken.no
Norway	2413	Vuomajavri	Målselv	Troms og Finmark	709	1.245	600				Bt,Ac	+	68.66330	19.50747	Fylkesmannen i Troms
Norway	50011	Adajavri	Målselv	Troms og Finmark	755	0.101	500				Bt,Ac	+	68.66797	20.11528	Fylkesmannen i Troms
Norway	2407	Ravdojavri	Målselv	Troms og Finmark	719	1.097	500				Bt,Ac,B	+	68.68040	20.17364	Fylkesmannen i Troms
Norway	49330	Koievatnet	Bardu	Troms og Finmark	499	0.565	655				Bt,Ac	0	68.69112	18.95640	M. Halvorsen, pers. comm.
Norway	2408	Anjajavre	Målselv	Troms og Finmark	621	1.428	650				Bt,Ac	+	68.71998	19.39326	T.G. Heggberget, pers. comm.

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Sweden	763434-169507	Råstojaure	Kiruna	Norrbotten	678	30.314	450			14.4	Bt,Ac,G,B	+	68.77552	20.43178	Hammar & Greer 2013
Norway	49866	Harvvesluobbalat	Målselv	Troms og Finmark	690	0.431	489				Bt,Ac,G	+	68.80112	20.23142	Fylkesmannen i Troms
Norway	49854	Harvvesjavri	Målselv	Troms og Finmark	704	0.601	489				Bt,Ac,G	+	68.80491	20.16603	Fylkesmannen i Troms
Norway	49244	Høgskardvatnet	Målselv	Troms og Finmark	680	0.332	650				Bt,Ac	+	68.81157	19.43748	Fylkesmannen i Troms
Norway	49208	Sandelvvatnet	Målselv	Troms og Finmark	733	0.636	650				Bt,Ac	+	68.83421	19.35408	Fylkesmannen i Troms
Norway	49214	Lappskardvatn	Målselv	Troms og Finmark	781	0.248	683				Bt,Ac	+	68.83647	19.26895	Fylkesmannen i Troms
Finland	71.111.1.001	Inarijärvi	Inari	Lappland	119	1 040.000	219	2.0	15.0	92.0	13 spec.	-	69.00377	27.79506	Lakka 2020
Finland		Kaitsajärvi	Enontekiö	Lappland	670	0.190	219					+	69.07574	21.42728	Lakka 2020
Norway	2398	Fjellfrøsvatn	Balsfjord	Troms og Finmark	125	6.749	508				Bt,Ac	-	69.08095	19.33968	Økland & Økland 2002
Norway	51861	Lombola	Balsfjord	Troms og Finmark	195	0.367	484				Bt,Ac	-	69.09017	19.19527	Primicerio & Klemetsen 1999
Finland	67.730.1.047	Hárrejávrit	Enontekiö	Lappland	666	0.830	219				P	+	69.10851	21.50891	Lakka 2020
Finland	67.740.1.099	Toskaljärvi	Enontekiö	Lappland	703	0.990	219				Ac	+	69.19065	21.44843	Lakka 2020
Finland		Cuovgijávri	Enontekiö	Lappland	750	0.002	219			4.0	Fishless	+	69.21000	21.30000	Koli 1955
Norway	51671	Storvatnet	Balsfjord	Troms og Finmark	305	0.794	694				Bt,Ac	-	69.23807	19.61700	artsdatabanken.no
Finland	67.770.1.016	Somaslompolo	Enontekiö	Lappland	729	0.530	219				Ac	+	69.26051	21.54460	Lakka 2020
Finland	67.770.1.023	Somasjärvi/ Somájávri	Enintekiö	Lappland	730	2.750	219			29.5	Ac	+	69.28333	21.53333	Järvinen et al. 2013
Norway	1729	Goddejavri	Kåfjord	Troms og Finmark	897	1.674	442				Bt,Ac	+	69.34362	20.93252	Abelvik & Elvenes 1996
Norway	1728	Guolasjavri	Kåfjord	Troms og Finmark	772	11.371	442	20.0			Bt,Ac	+	69.34530	21.11670	Svenning & Klemetsen 2001
Norway	2232	Jorbbisjav'ri	Kautokeino	Troms og Finmark	585	1.065	300				Bt,Ac,Em	+	69.47057	22.69286	artsdatabanken.no
Norway	2230	Rappesjav'ri	Kautokeino	Troms og Finmark	595	1.574	300				Bt	+	69.50466	22.64627	artsdatabanken.no
Norway	2233	Måkkejav'ri	Kautokeino	Troms og Finmark	614	2.391	263				Bt	+	69.50840	22.73809	Rikardsen et al. 2000
Norway	1819	Heisujavri	Kvænangen	Troms og Finmark	615	2.622	350				Bt,Ac	+	69.53140	22.61501	Fylkesmannen i Troms

Appendix 1. Continued.

Country	National ID no.	Locality	Municipality	County	Altitude m a.s.l.	Lake area km^2	Winter prec. mm	Regulated m	Average depth m	Max. depth m	Fish species*	Treeline	Latitude	Longitude	References
Norway	1814	Stuora Mollesjavri	Nordreisa	Troms og Finmark	781	2.336	400				Bt,Ac	+	69.54476	22.14433	Ø. Kandstad Hansen, pers. comm.
Norway	1820	Ballanjavri	Kvænangen	Troms og Finmark	615	1.575	300				Bt	+	69.56325	22.71661	Fylkesmannen i Troms
Norway	53900	Nabarvaggejavri	Kvænangen	Troms og Finmark	594	0.364	350				Bt,Ac,Em	+	69.57177	22.39897	Saksgård & Hesthagen 2000.
Norway	53885	Geallanjavrrit	Kautokeino	Troms og Finmark	698	0.201	250				Bt	+	69.57712	22.98849	artsdatabanken.no
Norway	1821	Abojav'ri	Kvænangen	Troms og Finmark	692	5.887	385				Bt,Ac	+	69.62085	22.19771	Ø. Kandstad Hansen, pers. comm.
Norway	10035	Ukjent	Tromsø	Troms og Finmark	490	0.005	699				Bt	+	69.62920	18.99728	artsdatabanken.no
Norway	52165	Kildalsdammen	Nordreisa	Troms og Finmark	258	1.003	453	14.5			Bt,Ac	0	69.64290	21.11701	Ø. Kandstad Hansen, pers. comm.
Norway	1826	Lassajavri	Kvænangen	Troms og Finmark	543	3.266	383	24.0			Bt,Ac	+	69.66973	22.18166	T.G. Heggberget, pers. comm.
Norway	2249	Skoaddulnobbalat	Alta	Troms og Finmark	583	1.206	456	1.5			Bt,Ac		69.78224	22.54079	artsdatabanken.no
Norway	2352	Lævnjasjav'ri	Porsanger	Troms og Finmark	453	4.116	329				Bt,Ac	+	69.84489	24.59486	E. Sivertsen, pers. comm.
Norway	59855	Gussajav'ri	Hammerfest	Troms og Finmark	317	0.092	402				Bt,Ac	0	70.17456	24.25113	artsdatabanken.no
Norway	61730	Márdasjävri	Lebesby	Troms og Finmark	213	7.496	250	3.4			Bt,Ac	+	70.26225	26.96547	artsdatabanken.no
Norway	61706	Vuolit Guorgajav'ri	Lebesby	Troms og Finmark	327	0.775	251				Bt,Ac	+	70.30020	27.25488	artsdatabanken.no
Norway	2323	Gabbatjavri	Lebesby	Troms og Finmark	212	1.006	250				Bt	+	70.31918	26.93089	Rikardsen et al. 2000
Norway	62833	Bergebyvatnet	Nesseby	Troms og Finmark	214	1.081	404				Bt	+	70.32855	29.22165	Berg 1954
Norway	2322	Sieidejavri	Lebesby	Troms og Finmark	213	1.588	250	4.1			Bt	+	70.34892	26.93877	Rikardsen et al. 2000
Norway	59667	Jovssebajávrrit	Hammerfest	Troms og Finmark	317	0.092	350				Bt,Ac	+	70.35128	24.54772	artsdatabanken.no
Norway	2255	Dåggejav'ri	Hammerfest	Troms og Finmark	290	2.947	365				Bt,Ac	+	70.37124	24.53407	artsdatabanken.no
Norway	2320	Store Måsavatnet	Lebesby	Troms og Finmark	207	14.722	250	32.0			Bt,Ac	+	70.37887	26.87889	Rikardsen et al. 2000
Norway	61376	Vidjevatn, Øvre	Lebesby	Troms og Finmark	299	0.262	265				Bt,Ac	+	70.41237	27.21378	artsdatabanken.no
Norway	61350	Vidjevatn, Nedre	Lebesby	Troms og Finmark	293	0.668	265				Bt,Ac	-	70.41935	27.18823	artsdatabanken.no
Norway	59528	Asajav'ri	Hammerfest	Troms og Finmark	284	0.361	448				Bt	+	70.45415	24.18257	artsdatabanken.no
Norway	59467	Eidevatn, Nedre	Porsanger	Troms og Finmark	90	0.791	440				Bt,Ac	-	70.52611	24.92037	artsdatabanken.no
Norway	2336	Balljaid-jav'ri	Måsøy	Troms og Finmark	285	1.157	602				Bt,Ac	+	70.74490	25.27817	artsdatabanken.no

Fish species*: Bt-Brown trout, Ac-Arctic char, Em-Eurasian minnow, G-grayling, B-burbot, P-perch, Wf-whitefish, Ns-ninespined stickleback, Abt-American brook trout, Lt-Lake trout.
Treeline: (+) – above treeline, (0) – at treeline, (-) – beneath treeline

Appendix 1. Continued.

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Appendix 2. Water temperature profiles obtained from 32 Norwegian lakes in southern part of the Scandes. Data from Lake Øvre Heimdalsvatn are from the long-term interdisciplinary project described in Brittain et al. (2010). The data are available from the database Hydra II (nve.no). *Lepidurus arcticus* is present in 26 of the lakes. (For specific information of the meteorological stations and the lakes, see Table 1 and Table 2, respectively).

Year	National ID no.	Lake	Altitude m a.s.l.	Winter prec. mm	*Lepidurus* lake	Mean water temp. 1.7-15.9	Station no.	Met. station	Altitude m a.s.l.	Air temp. at station	Lake air temp.	Diff. water vs air temp.
2006	876	Forollsjøen	992	596	x	12.95		Øvre Dølvad	848	11.07	10.21	2.74
2019	1906	Isdalsvatnet	832	726	x	14.57	31620	Møsstrond	977	10.71	11.58	2.99
2011	35414	Storinnsjøen	821	186	0	13.78		Own station at lake	821	10.52	10.52	3.26
2012	35414	Storinnsjøen	821	186	0	12.63		Own station at lake	821	9.29	9.29	3.34
2013	35414	Storinnsjøen	821	186	0	13.99		Own station at lake	821	10.81	10.81	3.18
2010	35414	Storinnsjøen	821	186	0	13.53	KVO	Øvre Dølvad	848	10.29	10.45	3.08
2011	35414	Storinnsjøen	821	186	0	13.78	KVO	Øvre Dølvad	848	10.62	10.78	3.00
2012	35414	Storinnsjøen	821	186	0	12.63	KVO	Øvre Dølvad	848	9.10	9.26	3.37
2013	35414	Storinnsjøen	821	186	0	13.99	KVO	Øvre Dølvad	848	10.51	10.67	3.32
2014	35414	Storinnsjøen	821	186	0	14.49	KVO	Øvre Dølvad	848	11.26	11.42	3.07
2016	35414	Storinnsjøen	821	186	0	13.22	KVO	Øvre Dølvad	848	9.76	9.92	3.30
2017	35414	Storinnsjøen	821	186	0	12.22	KVO	Øvre Dølvad	848	8.83	8.99	3.23
2018	109	Viuvatnet	1324	345	x	12.35	31620	Møsstrond	977	11.88	9.80	2.55
1985	272	Øvre Heimdalsvatn	1088	571	x	10.99	13670	Skåbu	890	9.15	7.96	3.03
1986	272	Øvre Heimdalsvatn	1088	571	x	11.34	13670	Skåbu	890	8.13	6.94	4.40
1987	272	Øvre Heimdalsvatn	1088	571	x	11.05	13670	Skåbu	890	8.91	7.72	3.33
1988	272	Øvre Heimdalsvatn	1088	571	x	10.89	13670	Skåbu	890	10.34	9.15	1.74
1989	272	Øvre Heimdalsvatn	1088	571	x	11.17	13670	Skåbu	890	9.54	8.35	2.82
1990	272	Øvre Heimdalsvatn	1088	571	x	11.54	13670	Skåbu	890	10.09	8.90	2.64
1991	272	Øvre Heimdalsvatn	1088	571	x	13.25	13670	Skåbu	890	11.61	10.42	2.83
1992	272	Øvre Heimdalsvatn	1088	571	x	11.20	13670	Skåbu	890	8.53	7.34	3.86
1993	272	Øvre Heimdalsvatn	1088	571	x	10.38	13670	Skåbu	890	8.10	6.91	3.47
1994	272	Øvre Heimdalsvatn	1088	571	x	12.48	13670	Skåbu	890	11.25	10.06	2.42
1995	272	Øvre Heimdalsvatn	1088	571	x	12.47	13670	Skåbu	890	10.46	9.27	3.20
1996	272	Øvre Heimdalsvatn	1088	571	x	12.09	13670	Skåbu	890	9.95	8.76	3.33
1997	272	Øvre Heimdalsvatn	1088	571	x	13.89	13670	Skåbu	890	12.38	11.19	2.70
1998	272	Øvre Heimdalsvatn	1088	571	x	10.91	13670	Skåbu	890	9.07	7.88	3.03
2000	272	Øvre Heimdalsvatn	1088	571	x	11.80	13670	Skåbu	890	9.24	8.05	3.75
2001	272	Øvre Heimdalsvatn	1088	571	x	11.30	13670	Skåbu	890	9.71	8.52	2.78
2002	272	Øvre Heimdalsvatn	1088	571	x	14.17	13670	Skåbu	890	12.40	11.22	2.96
2003	272	Øvre Heimdalsvatn	1088	571	x	12.89	13670	Skåbu	890	11.31	10.12	2.78

Appendix 2. Continued.

Year	National ID no.	Lake	Altitude m a.s.l.	Winter prec. mm	*Lepidurus* lake	Mean water temp. 1.7-15.9	Station no.	Met. station	Altitude m a.s.l.	Air temp. at station	Lake air temp.	Diff. water vs air temp.
2004	272	Øvre Heimdalsvatn	1088	571	x	12.80	13670	Skåbu	890	10.15	8.96	3.84
2005	272	Øvre Heimdalsvatn	1088	571	x	12.45	13670	Skåbu	890	10.66	9.47	2.98
2006	272	Øvre Heimdalsvatn	1088	571	x	14.27	13670	Skåbu	890	12.11	10.92	3.36
2007	272	Øvre Heimdalsvatn	1088	571	x	10.74	13670	Skåbu	890	9.33	8.14	2.59
2008	272	Øvre Heimdalsvatn	1088	571	x	12.55	13670	Skåbu	890	10.10	8.91	3.64
2009	272	Øvre Heimdalsvatn	1088	571	x	12.20	13670	Skåbu	890	10.09	8.90	3.30
2011	272	Øvre Heimdalsvatn	1088	571	x	12.17	13670	Skåbu	928	10.43	9.47	2.70
2012	272	Øvre Heimdalsvatn	1088	571	x	11.55	13670	Skåbu	928	9.27	8.31	3.24
2013	272	Øvre Heimdalsvatn	1088	571	x	12.72	13670	Skåbu	928	10.85	9.89	2.83
2014	272	Øvre Heimdalsvatn	1088	571	x	13.34	13670	Skåbu	928	11.61	10.65	2.70
2015	272	Øvre Heimdalsvatn	1088	571	x	10.90	13670	Skåbu	928	9.75	8.79	2.12
2016	272	Øvre Heimdalsvatn	1088	571	x	12.36	13670	Skåbu	928	10.20	9.24	3.12
2017	272	Øvre Heimdalsvatn	1088	571	x	12.35	13670	Skåbu	928	9.02	8.06	4.29
2018	272	Øvre Heimdalsvatn	1088	571	x	14.38	13670	Skåbu	928	11.76	10.80	3.59
2016	1910	Langavatn	1222	542	x	10.88	31620	Møsstrond	977	9.98	8.51	2.37
2016	27430	Tinnhølen	1213	528	x	11.10	31620	Møsstrond	977	9.98	8.57	2.53
2004	393	Dragøyfjorden	1180	487	x	10.81	31620	Møsstrond	977	10.17	8.95	1.86
2005	393	Dragøyfjorden	1180	487	x	7.98	31620	Møsstrond	977	10.65	9.43	-1.45
2006	393	Dragøyfjorden	1180	487	x	12.01	31620	Møsstrond	977	12.48	11.26	0.75
2007	393	Dragøyfjorden	1180	487	x	8.38	31620	Møsstrond	977	9.33	8.11	0.27
2008	393	Dragøyfjorden	1180	487	x	9.13	31620	Møsstrond	977	10.25	9.04	0.10
2009	393	Dragøyfjorden	1180	487	x	10.38	31620	Møsstrond	977	10.19	8.97	1.41
2010	393	Dragøyfjorden	1180	487	x	10.35	31620	Møsstrond	977	10.21	8.99	1.36
2011	393	Dragøyfjorden	1180	487	x	10.29	31620	Møsstrond	977	10.26	9.04	1.25
2012	393	Dragøyfjorden	1180	487	x	7.62	31620	Møsstrond	977	9.53	8.31	-0.69
2013	393	Dragøyfjorden	1180	487	x	10.26	31620	Møsstrond	977	10.99	9.78	0.48
2015	393	Dragøyfjorden	1180	487	x	5.77	31620	Møsstrond	977	9.53	8.31	-2.54
2016	393	Dragøyfjorden	1180	487	x	8.88	31620	Møsstrond	977	9.98	8.77	0.11
2017	393	Dragøyfjorden	1180	487	x	9.13	31620	Møsstrond	977	8.96	7.74	1.39
2018	393	Dragøyfjorden	1180	487	x	12.23	31620	Møsstrond	977	11.88	10.66	1.57
2019	393	Dragøyfjorden	1180	487	x		31620	Møsstrond	977	10.71	9.49	
2019	393	Dragøyfjorden	1180	487	x			Own station at the lake	1180	9.59	9.59	
2003	17018	Svartevasstjørni	1243	498	x	10.52	31620	Møsstrond	977	11.39	9.79	0.73

Appendix 2. Continued.

Year	National ID no.	Lake	Altitude m a.s.l.	Winter prec. mm	*Lepidurus* lake	Mean water temp. 1.7-15.9	Station no.	Met. station	Altitude m a.s.l.	Air temp. at station	Lake air temp.	Diff. water vs air temp.
2004	17018	Svartevasstjørni	1243	498	x	10.90	31620	Møsstrond	977	10.17	8.58	2.33
2005	17018	Svartevasstjørni	1243	498	x	8.48	31620	Møsstrond	977	10.65	9.05	-0.57
2006	17018	Svartevasstjørni	1243	498	x	12.72	31620	Møsstrond	977	12.48	10.88	1.84
2007	17018	Svartevasstjørni	1243	498	x	8.06	31620	Møsstrond	977	9.33	7.73	0.33
2008	17018	Svartevasstjørni	1243	498	x	9.68	31620	Møsstrond	977	10.25	8.66	1.02
2009	17018	Svartevasstjørni	1243	498	x	9.92	31620	Møsstrond	977	10.19	8.59	1.32
2010	17018	Svartevasstjørni	1243	498	x	10.85	31620	Møsstrond	977	10.21	8.61	2.24
2011	17018	Svartevasstjørni	1243	498	x	10.71	31620	Møsstrond	977	10.26	8.66	2.05
2012	17018	Svartevasstjørni	1243	498	x	8.23	31620	Møsstrond	977	9.53	7.94	0.29
2013	17018	Svartevasstjørni	1243	498	x	10.80	31620	Møsstrond	977	10.99	9.40	1.40
2015	17018	Svartevasstjørni	1243	498	x	6.07	31620	Møsstrond	977	9.53	7.94	-1.86
2016	17018	Svartevasstjørni	1243	498	x	9.83	31620	Møsstrond	977	9.98	8.39	1.45
2017	17018	Svartevasstjørni	1243	498	x	9.29	31620	Møsstrond	977	8.96	7.36	1.93
2018	17018	Svartevasstjørni	1243	498	x	12.96	31620	Møsstrond	977	11.88	10.28	2.68
2018	18034	Djupavatnet	1291	840	x	12.36	31620	Møsstrond	977	11.88	10.00	2.36
2016	1913	Omkjelsvatnet Nedre	1199	871	x	9.55	31620	Møsstrond	977	9.98	8.65	0.90
2017	1913	Omkjelsvatnet Nedre	1199	871	x	9.13	31620	Møsstrond	977	8.96	7.63	1.50
2018	1913	Omkjelsvatnet Nedre	1199	871	x	12.88	31620	Møsstrond	977	11.88	10.55	2.33
2016	27637	Omkjelsvatnet Øvre	1202	939	0	6.69	31620	Møsstrond	977	9.98	8.63	-1.94
2016	1904	Opesjovatnet	1014	988	0	10.49	31620	Møsstrond	977	9.98	9.76	0.73
2017	1904	Opesjovatnet	1014	988	0	9.74	31620	Møsstrond	977	8.96	8.74	1.00
2018	1904	Opesjovatnet	1014	988	0	13.57	31620	Møsstrond	977	11.88	11.66	1.91
2016	1912	Veivatnet	1172	893	x	9.14	31620	Møsstrond	977	9.98	8.81	0.33
2017	1912	Veivatnet	1172	893	x	9.05	31620	Møsstrond	977	8.96	7.79	1.26
2017	1912	Veivatnet	1172	893	x	9.05		Own station at lake	1185	7.84	7.92	1.26
2018	1912	Veivatnet	1172	893	x	12.93	31620	Møsstrond	977	11.88	10.71	2.22
2018	1912	Veivatnet	1172	893	x	12.93		Own station at lake	1185	10.53	10.61	2.22
2006	13	Briskevatn	1068	611	x	13.86	31620	Møsstrond	977	12.48	11.93	1.93
2015	13	Briskevatn	1068	611	x	8.50	31620	Møsstrond	977	9.53	8.99	-0.49
2016	13	Briskevatn	1068	611	x	10.60	31620	Møsstrond	977	9.98	9.44	1.16
2019	13	Briskevatn	1068	611	x	13.49	31620	Møsstrond	977	10.71	10.16	3.33
2006	14	Gunleiksbuvatn	1076	652	x	13.96	31620	Møsstrond	977	12.48	11.89	2.07
2015	14	Gunleiksbuvatn	1076	652	x	8.00	31620	Møsstrond	977	9.53	8.94	-0.94

Appendix 2. Continued.

Year	National ID no.	Lake	Altitude m a.s.l.	Winter prec. mm	*Lepidurus* lake	Mean water temp. 1.7-15.9	Station no.	Met. station	Altitude m a.s.l.	Air temp. at station	Lake air temp.	Diff. water vs air temp.
2018	14	Gunleiksbuvatn	1076	652	x	13.83	31620	Møsstrond	977	11.88	11.29	2.54
2003	17	Sandvatn	1112	696	x	12.20	31620	Møsstrond	977	11.39	10.58	1.62
2004	17	Sandvatn	1112	696	x	11.67	31620	Møsstrond	977	10.17	9.36	2.31
2005	17	Sandvatn	1112	696	x	10.37	31620	Møsstrond	977	10.65	9.84	0.53
2006	17	Sandvatn	1112	696	x	14.02	31620	Møsstrond	977	12.48	11.67	2.35
2007	17	Sandvatn	1112	696	x	8.29	31620	Møsstrond	977	9.33	8.52	-0.23
2008	17	Sandvatn	1112	696	x	10.78	31620	Møsstrond	977	10.25	9.44	1.34
2009	17	Sandvatn	1112	696	x	10.94	31620	Møsstrond	977	10.19	9.38	1.56
2010	17	Sandvatn	1112	696	x	11.59	31620	Møsstrond	977	10.21	9.40	2.20
2011	17	Sandvatn	1112	696	x	10.90	31620	Møsstrond	977	10.26	9.45	1.45
2013	17	Sandvatn	1112	696	x	11.84	31620	Møsstrond	977	10.99	10.18	1.65
2014	17	Sandvatn	1112	696	x	11.74	31620	Møsstrond	977	11.44	10.63	1.11
2017	17	Sandvatn	1112	696	x	10.53	31620	Møsstrond	977	8.96	8.15	2.38
2018	17	Sandvatn	1112	696	x	13.76	31620	Møsstrond	977	11.88	11.07	2.69
2019	17	Sandvatn	1112	696	x	12.84	31620	Møsstrond	977	10.71	9.90	2.94
2006	12	Vollevatn	1030	605	x	14.33	31620	Møsstrond	977	12.48	12.16	2.17
2013	12	Vollevatn	1030	605	x	12.69	31620	Møsstrond	977	10.99	10.67	2.02
2015	12	Vollevatn	1030	605	x	8.82	31620	Møsstrond	977	9.53	9.21	-0.39
2016	12	Vollevatn	1030	605	x	11.21	31620	Møsstrond	977	9.98	9.67	1.54
2018	12	Vollevatn	1030	605	x	13.88	31620	Møsstrond	977	11.88	11.56	2.32
2019	12	Vollevatn	1030	605	x	13.48	31620	Møsstrond	977	10.71	10.39	3.09
2012	396	Geitvatnet	1197	496	x	10.43	31620	Møsstrond	977	9.53	8.21	2.22
2013	396	Geitvatnet	1197	496	x	12.20	31620	Møsstrond	977	10.99	9.67	2.53
2013	395	Langesjøen	1112	441	x	11.87	31620	Møsstrond	977	10.99	10.18	1.69
2018	420	Nordmannslågen	1244	547	x	12.87	31620	Møsstrond	977	11.88	10.28	2.59
2017	390	Orsjoren	951	424	x	11.18	31620	Møsstrond	977	8.96	9.12	2.06
2004	18770	Blånuttjørnan	1313	512	x	10.78	31620	Møsstrond	977	10.17	8.16	2.62
2003	18827	Dargesjåen	1209	500	x	12.59	31620	Møsstrond	977	11.39	10.00	2.59
2004	18827	Dargesjåen	1209	500	x	11.74	31620	Møsstrond	977	10.17	8.78	2.96
2005	18827	Dargesjåen	1209	500	x	12.11	31620	Møsstrond	977	10.65	9.25	2.86
2006	18827	Dargesjåen	1209	500	x	13.74	31620	Møsstrond	977	12.48	11.09	2.65
2007	18827	Dargesjåen	1209	500	x	10.12	31620	Møsstrond	977	9.33	7.94	2.18
2008	18827	Dargesjåen	1209	500	x	12.04	31620	Møsstrond	977	10.25	8.86	3.18
2009	18827	Dargesjåen	1209	500	x	11.52	31620	Møsstrond	977	10.19	8.80	2.72

Appendix 2. Continued.

Year	National ID no.	Lake	Altitude m a.s.l.	Winter prec. mm	*Lepidurus* lake	Mean water temp. 1.7-15.9	Station no.	Met. station	Altitude m a.s.l.	Air temp. at station	Lake air temp.	Diff. water vs air temp.
2010	18827	Dargesjåen	1209	500	x	11.71	31620	Møsstrond	977	10.21	8.81	2.90
2011	18827	Dargesjåen	1209	500	x	12.05	31620	Møsstrond	977	10.26	8.86	3.19
2012	18827	Dargesjåen	1209	500	x	10.39	31620	Møsstrond	977	9.53	8.14	2.25
2013	18827	Dargesjåen	1209	500	x	12.08	31620	Møsstrond	977	10.99	9.60	2.48
2014	18827	Dargesjåen	1209	500	x	13.14	31620	Møsstrond	977	11.44	10.05	3.09
2016	18827	Dargesjåen	1209	500	x	11.02	31620	Møsstrond	977	9.98	8.59	2.43
2017	18827	Dargesjåen	1209	500	x	10.34	31620	Møsstrond	977	8.96	7.57	2.77
2018	18827	Dargesjåen	1209	500	x	13.60	31620	Møsstrond	977	11.88	10.49	3.11
2019	18827	Dargesjåen	1209	500	x	13.06	31620	Møsstrond	977	10.71	9.32	3.74
2006	35279	Fjellsjøen	973	577	x	13.30		Øvre Dølvad	848	11.07	10.32	2.98
2006	39	Fjellsjåen	1197	495	x	13.37	31620	Møsstrond	977	12.48	11.16	2.21
2010	39	Fjellsjåen	1197	495	x	11.35	31620	Møsstrond	977	10.21	8.89	2.46
2012	39	Fjellsjåen	1209	495	x	10.21	31620	Møsstrond	977	9.53	8.14	2.07
2013	39	Fjellsjåen	1209	495	x	11.66	31620	Møsstrond	977	10.99	9.60	2.06
2004	18854	Kringlesjåen	1258	493	x	11.15	31620	Møsstrond	977	10.17	8.49	2.66
2017	17281	Holværvatn	1183	355	x	10.64	25630	Geilo-Olderbråten	772	9.97	7.50	3.14
2018	17281	Holværvatn	1183	355	x	13.14	25630	Geilo-Olderbråten	772	12.43	9.96	3.18
2017	17371	Skjerjavatn	1192	369	x	10.68	25630	Geilo-Olderbråten	772	9.97	7.45	3.23
2018	17371	Skjerjavatn	1192	369	x	13.27	25630	Geilo-Olderbråten	772	12.43	9.91	3.36
2019	17371	Skjerjavatn	1192	369	x	12.73	25630	Geilo-Olderbråten	772	11.50	8.98	3.75
1911	389	Skurdalsvatnet	780	314	0		25720	Haugastøl II*	996	9.55	10.85	
1914	389	Skurdalsvatnet	780	314	0		25720	Haugastøl II*	996	11.75	13.05	
1917	389	Skurdalsvatnet	780	314	0		25720	Haugastøl II*	996	10.72	12.02	
1921	389	Skurdalsvatnet	780	314	0		25720	Haugastøl II	996	8.22	9.52	
1922	389	Skurdalsvatnet	780	314	0		25720	Haugastøl II	996	8.20	9.50	
1923	389	Skurdalsvatnet	780	314	0		25720	Haugastøl II	996	7.89	9.19	
1974	389	Skurdalsvatnet	780	314	0		25630	Haugastøl II	996	8.28	9.58	
1975	389	Skurdalsvatnet	780	314	0		25630	Haugastøl II	996	10.80	12.10	
2017	389	Skurdalsvatnet	780	314	0	13.87	25630	Geilo-Olderbråten	772	9.97	9.92	3.95
2018	389	Skurdalsvatnet	780	314	0	15.84	25630	Geilo-Olderbråten	772	12.43	12.38	3.46
2011	16246	Buhovdvatnet	977	284	0	13.15	25630	Geilo-Olderbråten	772	11.35	10.12	3.03
2013	16246	Buhovdvatnet	977	284	0	13.60	25630	Geilo-Olderbråten	772	11.78	10.55	3.05
2016	16246	Buhovdvatnet	977	284	0	13.09	25630	Geilo-Olderbråten	772	11.03	9.80	3.29

Appendix 2. Continued.

Year	National ID no.	Lake	Altitude m a.s.l.	Winter prec. mm	*Lepidurus* lake	Mean water temp. 1.7-15.9	Station no.	Met. station	Altitude m a.s.l.	Air temp. at station	Lake air temp.	Diff. water vs air temp.
2018	16246	Buhovdvatnet	977	284	0	15.01	25630	Geilo-Olderbråten	772	12.43	11.20	3.81
2018	16246	Buhovdvatnet	977	284	0	15.01		Own station at lake	1030	11.87	11.55	3.46
2012	16334	Øknevatni	940	263	0	13.37	25630	Geilo-Olderbråten	772	10.41	9.40	3.97
2013	16334	Øknevatni	940	263	0	14.71	25630	Geilo-Olderbråten	772	11.78	10.77	3.94
2013	16334	Øknevatni	940	263	0	14.71		Own station at lake	1030	11.13	10.59	4.12
2016	16334	Øknevatni	940	263	0	13.53	25630	Geilo-Olderbråten	772	11.03	10.02	3.51