West Sutherland Fisheries Trust

2018 Electro-fishing Surveys

A report to the West Sutherland Fisheries Trust, Report No. WSFT01/19

January 2019

Adam Beynon-Jones
Fisheries Biologist
West Sutherland Fisheries Trust
Gardeners Cottage
Scourie
By Lairg
Sutherland
IV27 4SX

1. Introduction

During 2018 West Sutherland Fisheries Trust undertook a new program of electro-fishing survey sites under contract from Marine Scotland Science in order to gather data to be trialled for potential calculation of conservation limits for salmon. The sites were picked at random across a variety of West Sutherland catchments, in areas accessible to salmon. Nine of these sites were sampled using SFCC protocol fully quantitative survey method, with the remaining 12 surveyed as SFCC protocol semi quantitative surveys. Due to the large workload of this surveying program in combination with adverse weather conditions, it was only possible to repeat a small amount of WSFT's routine monitoring work during 2018: One site from the Polla catchment (P4A) was repeated, and the Rhiconich Catchment was also repeat surveyed (sites R1, R2, R3, and R5). These routine semi quantitative surveys allow sites and catchments to be compared over time, showing trends in population dynamics. Data from these survey sites has been included in this report, and a report specific to the Rhiconich catchment is available on request.

Method

Electro-fishing equipment operates by creating an electrical field in the water which affects the muscles of the fish, causing them to swim towards the positive electrode (anode) and subsequently immobilises them for a brief period; at this point they can be captured for processing before being released unharmed into the river sections from which they were caught. As the electrical field is restricted in size and the conductivity of the water generally extremely low in all WSFT catchments, the best operating conditions are within shallow water in narrow tributaries. While it is possible to sample large main river stems, the escape rate is higher than that found in the narrower tributaries. Similarly, a high escape rate is found in exceptionally shallow, stony or weedy areas, where fish can move into the substrate and are thus inaccessible to the nets.

Fish densities were assessed using an electracatch backpack supplying smooth direct current (DC). Fish drawn to the hand-held anode were netted into a bucket, most commonly using small hand nets due to the narrow water channels and slow flows, and were retained until the end of the run for processing. The sites were fished systematically in an upstream direction, applying the same fishing pressure throughout to ensure that all fish had the same probability of capture as far as possible, thus increasing the reliability and accuracy of fish densities.

All fish were anaesthetised using 2 Phenoxyethanol, identified to species and measured (± 1 mm). Scale samples were taken from for age determination, and genetic samples were taken from a proportion of specimens during fully quantitative surveys. The fish were then placed in a bucket before being returned to the survey site upon complete recovery.

This report presents the data gathered from these surveys as minimum density estimates per $100m^2$ (e.g. data from the 1^{st} sample run only) in order to present a picture of juvenile salmonid densities across the West Sutherland area for 2018 to allow comparison across all sites. Water level was not used in the density estimates, although it must be realised that stream conditions will have an impact on the density determined and efficiency of the fishing technique. Bankside and instream characteristics, including substrate type, water flow, and riparian cover, were recorded at each site in accordance with the SFCC habitat survey associated with electrofishing surveys.

Site codes for the new survey program are displayed in Table 1 as: WestSutherland_ followed by a 4 figure suffix. However, for simplicity of recognising local catchments this report presents site codes within graphs as: "River catchment"_"xxxx": E.g. Polla_4508. The 4 figure suffix allows for cross

referencing. Figure 1 shows the location of survey sites, with catchment labelled once alongside suffix codes. For further simplicity, succeeding maps display the catchment only.

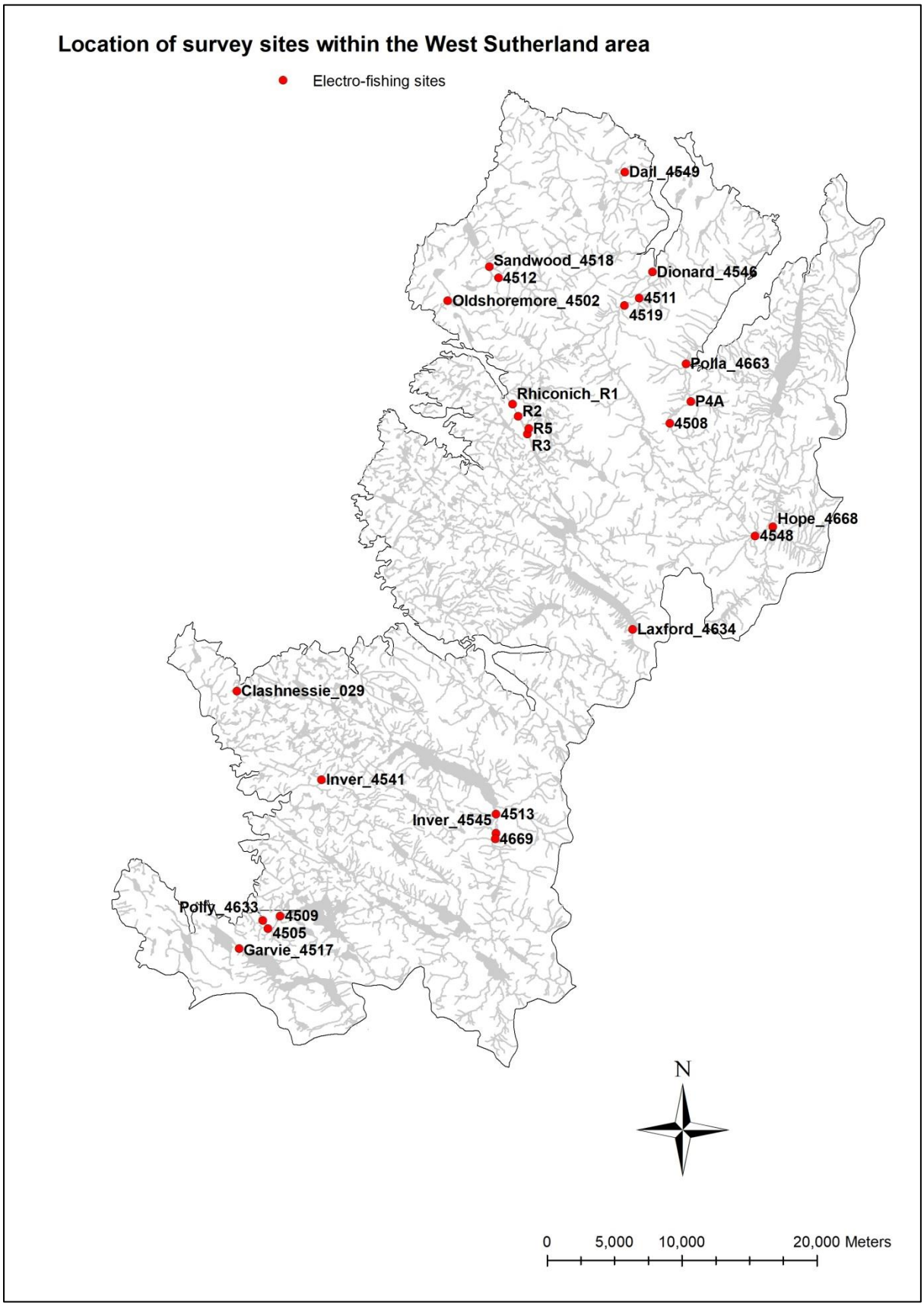

Figure 1: *Location of survey sites within the West Sutherland area*

2. Results

Site Code	Easting	Northing	Catchment	Minimum Density (100m^2) Salmon Fry	Salmon Parr	Trout Fry	Trout Parr
WestSutherland_4548	221093	941849	Hope	13.48	6.74	5.62	7.30
WestSutherland_4668	205458	942521	Hope	2.48	4.34	3.10	1.24
P4A	243885	951800	Polla	47.93	19.53	23.08	1.78
WestSutherland_4508	239100	950178	Polla	30.27	32.05	7.72	7.72
WestSutherland_4663	237544	954594	Polla	57.72	19.52	0	0
WestSutherland_4519	238759	958915	Dionard	9.17	0.57	0	0
WestSutherland_4546	227100	961396	Dionard	17.65	8.44	0	0
WestSutherland_4511	227000	959468	Dionard	7.22	0.52	1.55	0
WestSutherland_4549	226300	968787	Daill	0	0	40.62	0
WestSutherland_4518*	225900	961797	Sandwood	0	0	0	0.95
WestSutherland_4512*	234209	960961	Sandwood	1.53	0.76	0	0
WestSutherland_4502	234200	959261	Oldshoremore	0	1.79	0.89	3.58
R1	205638	951600	Rhiconich	28.35	2.18	0	0
R2	235284	950700	Rhiconich	2.40	2.40	0	0
R3	236262	949400	Rhiconich	68.45	56.55	2.98	0
R5	236262	949800	Rhiconich	69.82	13.96	1.40	0
WestSutherland_4634	245194	934939	Laxford	71.97	40.43	38.01	5.66
PmusselWestSutherland_029	224668	930372	Clashnessie	0	0	7.10	7.10
WestSutherland_4545	211745	919828	Inver	52.95	53.77	8.96	0.81
WestSutherland_4541	224605	923799	Inver	0	0	2.48	9.99
WestSutherland_4669	224666	919409	Inver	25.55	18.25	4.87	0
WestSutherland_4513	234786	921240	Inver	1.57	0	0	0
WestSutherland_4505	207760	912772	Polly	24.00	11.48	4.17	3.13
WestSutherland_4633	207390	913373	Polly	21.85	27.32	0	0.91
WestSutherland_4509	208668	913706	Polly	107.57	44.5	2.78	0
WestSutherland_4517	224167	911298	Garvie	7.31	19.31	2.09	0.52

Table 1: *A summary of the density of salmon and trout fry (0+ years) and parr (greater than 1 year) at each site per 100 m^2*

**Survey not effective due to adverse river conditions and equipment failure*

Species/age class	Minimum	Maximum	Mean
Salmon fry	0	107.57	25.74
Salmon parr	0	56.55	14.78
Trout fry	0	40.62	6.05
Trout parr	0	9.99	1.95

Table 2: *A summary of the densities determined for all sites surveyed*

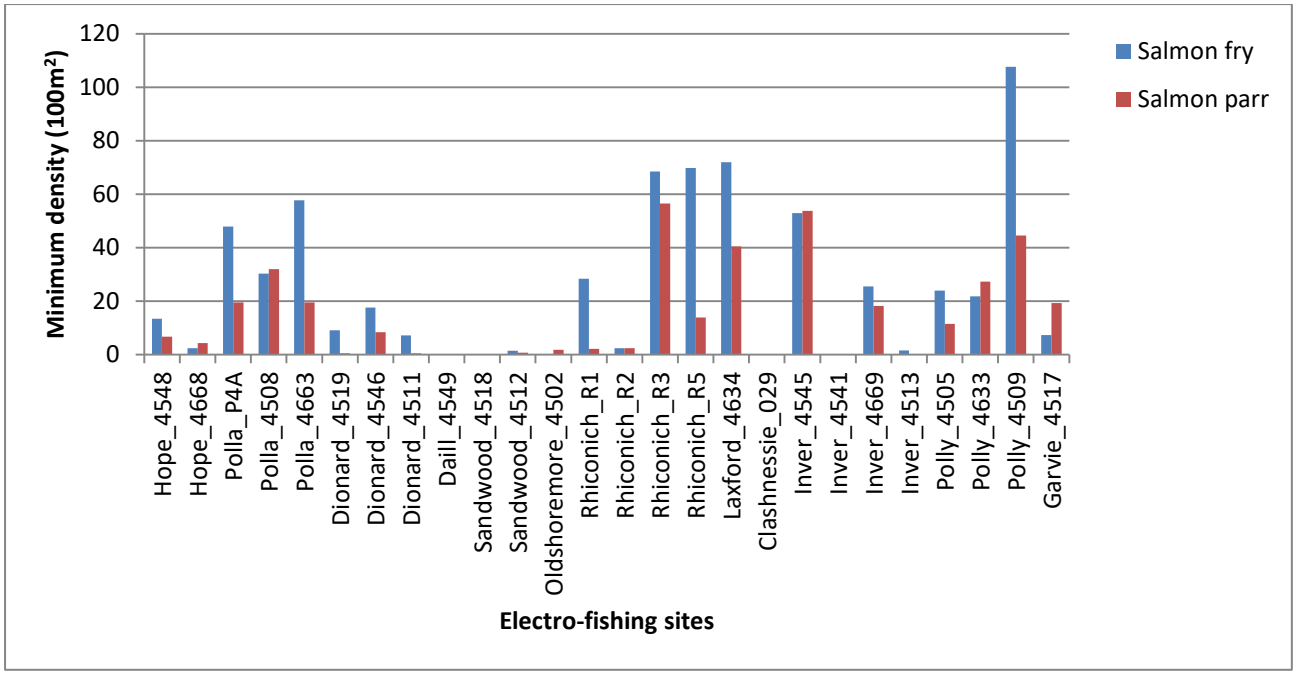

Figure 2: *Juvenile salmon densities by survey site*

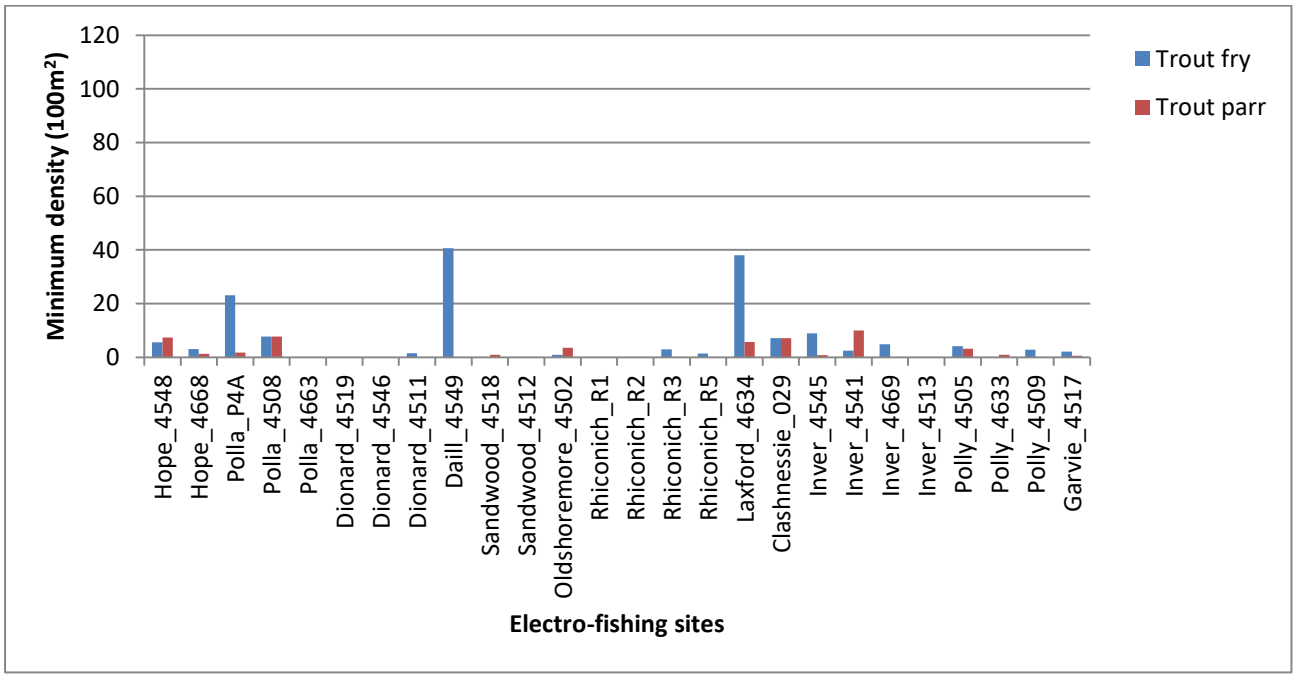

Figure 3: *Juvenile trout densities by survey site*

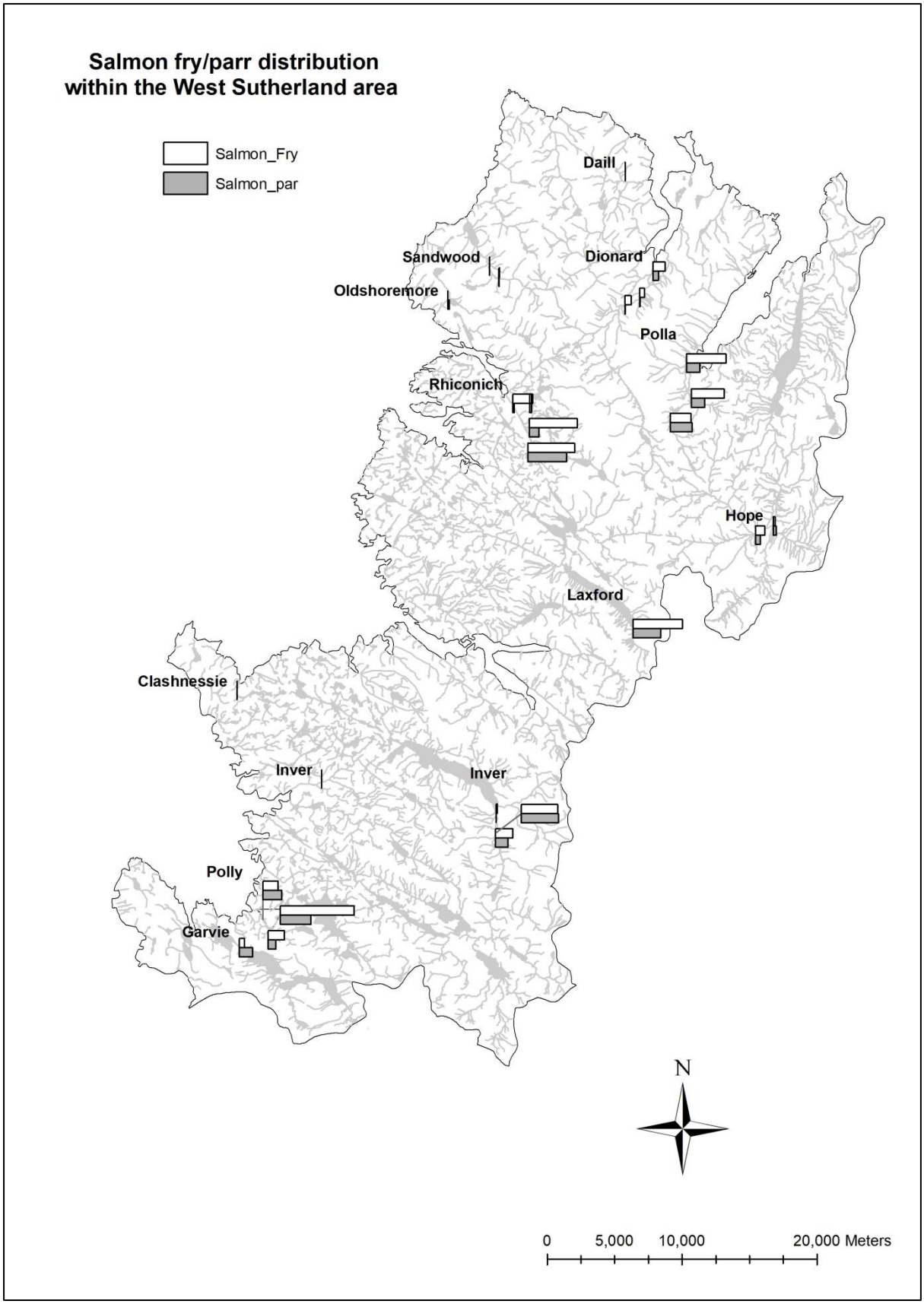

Figure 4: *Salmon fry/parr distribution across the West Sutherland survey sites*

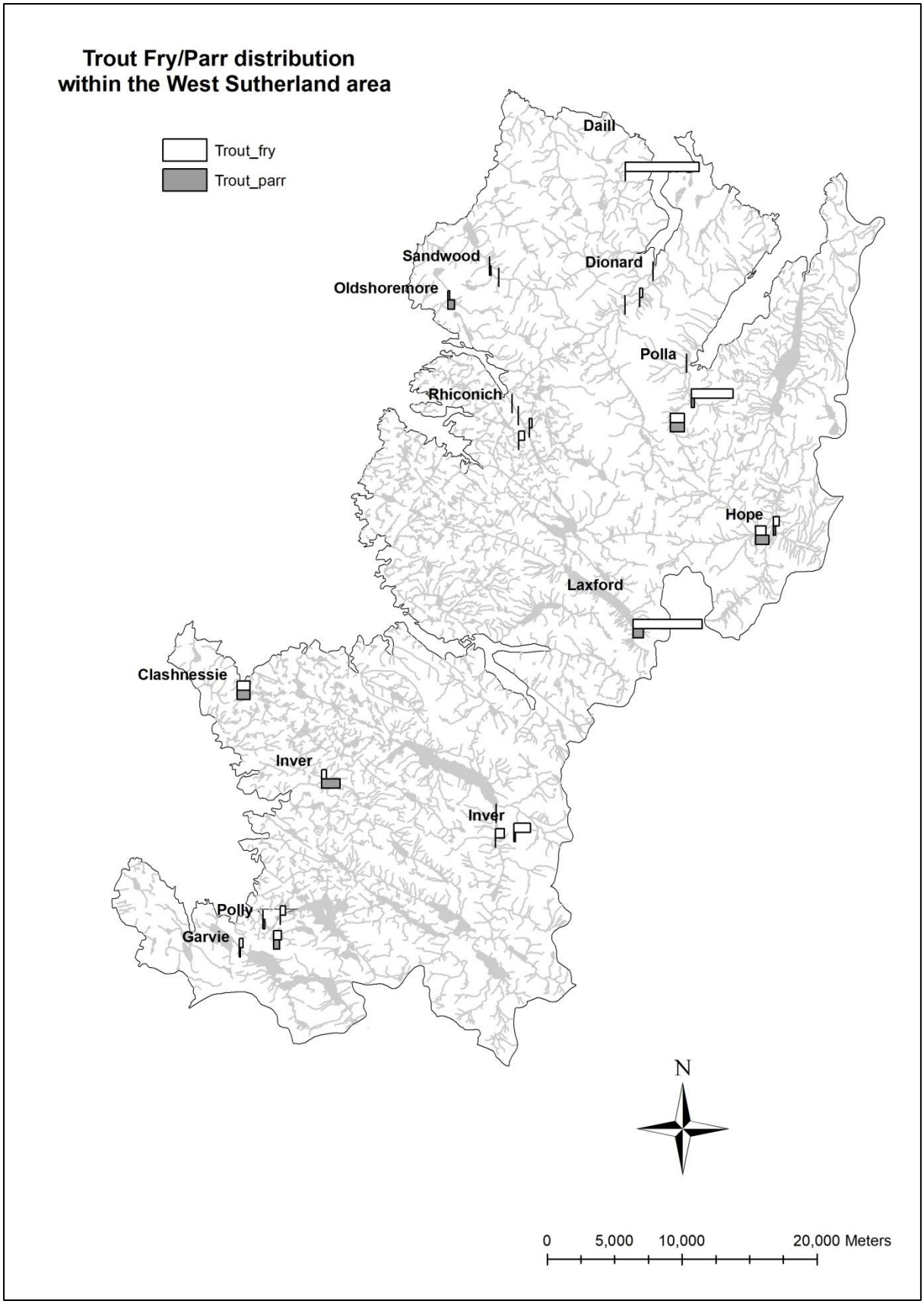

Figure 5: *Trout fry/parr distribution across the West Sutherland survey sites*

3. SFCC Classification

The SFCC absolute regional classification scheme, presented in Table 3, was developed so that fish populations could be compared across Scotland, allowing electrofishing results in Sutherland to be presented in a Scottish context. Unlike the relative regional classification scheme, this does not take into account river width which is known to affect salmonid densities with generally more fish present in narrower tributaries. When compared to the SFCC regional classification scheme for the North West area, salmonid densities range from absent (unclassified) to excellent and there is a lot of within-catchment variation, in part due to the location, habitat type, and accessibility to migratory fish.

		Minimum density per 100m^2			
SFCC Class	**Descriptor**	**Salmon fry**	**Salmon parr**	**Trout fry**	**Trout parr**
A	Excellent	26.05	13.09	15.80	8.58
B	Good	14.15	8.04	8.25	4.31
C	Moderate	8.00	4.67	4.26	2.72
D	Poor	4.42	2.58	1.99	1.52
E	Very poor	0.78	0.66	0.44	0.22
U	Unclassified	0	0	0	0

Table 3: *SFCC salmonid density classification scheme for the North West area*

The percentages of SFCC classifications across the west Sutherland area for 2018 are displayed in Figure 4. 57% of all sites were classed as having moderate to excellent salmon fry densities (34% classed as excellent), with salmon parr densities classed as moderate to excellent within 53% of all sites (42% classed as excellent). Trout fry densities were classed as moderate to excellent in 30% of all sites, (11% classed as excellent), with 26% of sites containing moderate to excellent trout parr densities (3% classed as excellent).

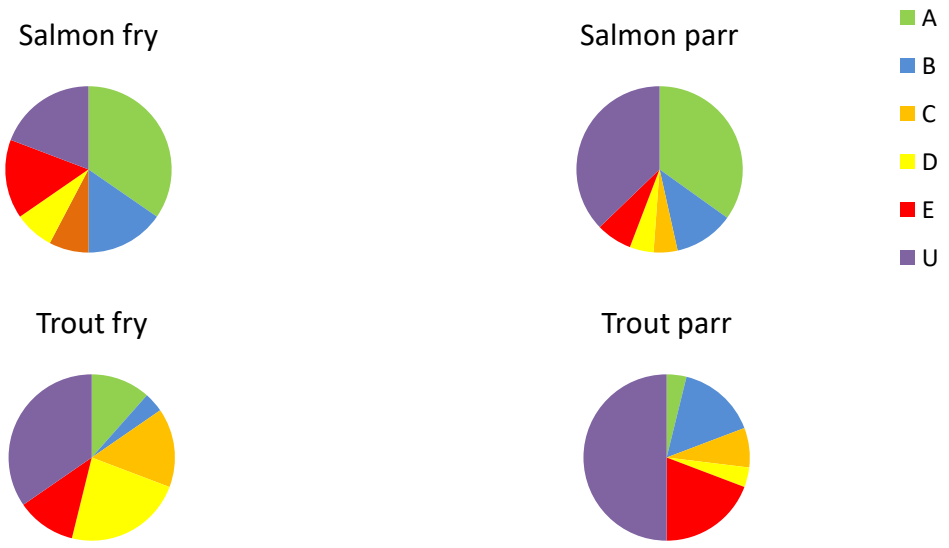

Figure 6: *West Sutherland area salmonid densities according to the SFCC classification scheme*

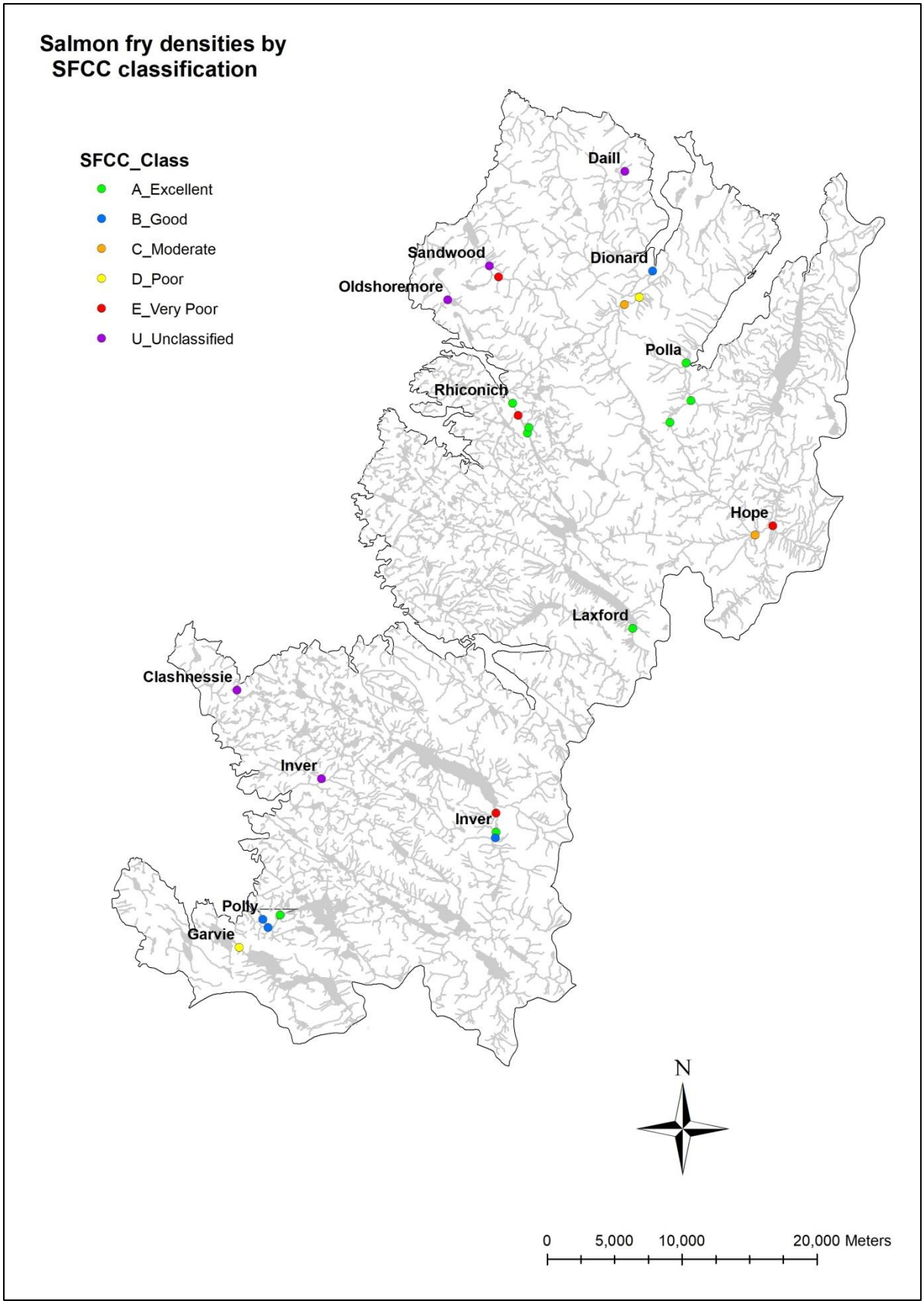

Figure 7: *Salmon fry densities according to the SFCC regional classification scheme*

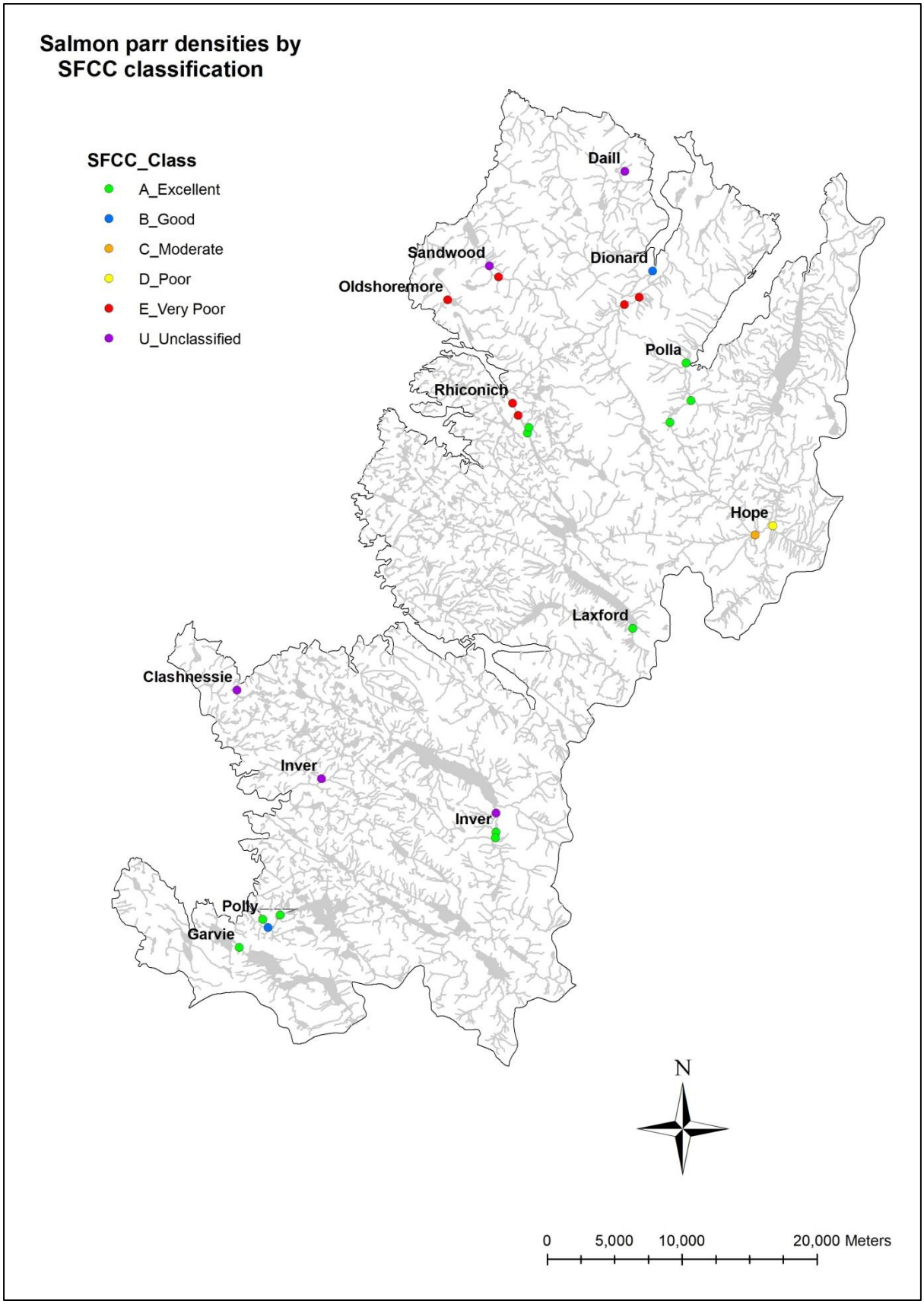

Figure 8: *Salmon parr densities according to the SFCC regional classification scheme*

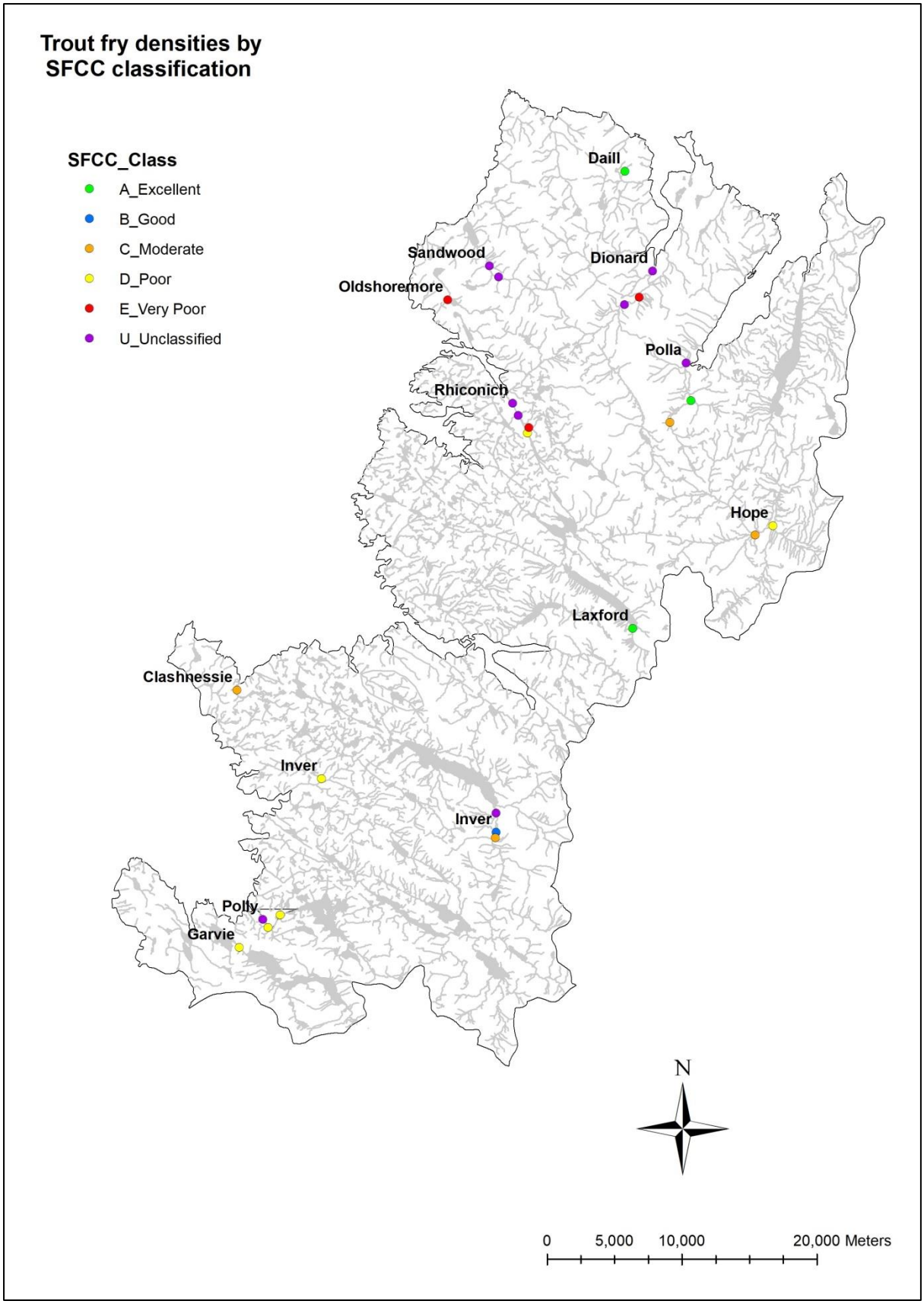

Figure 9: *Trout fry densities according to the SFCC regional classification scheme*

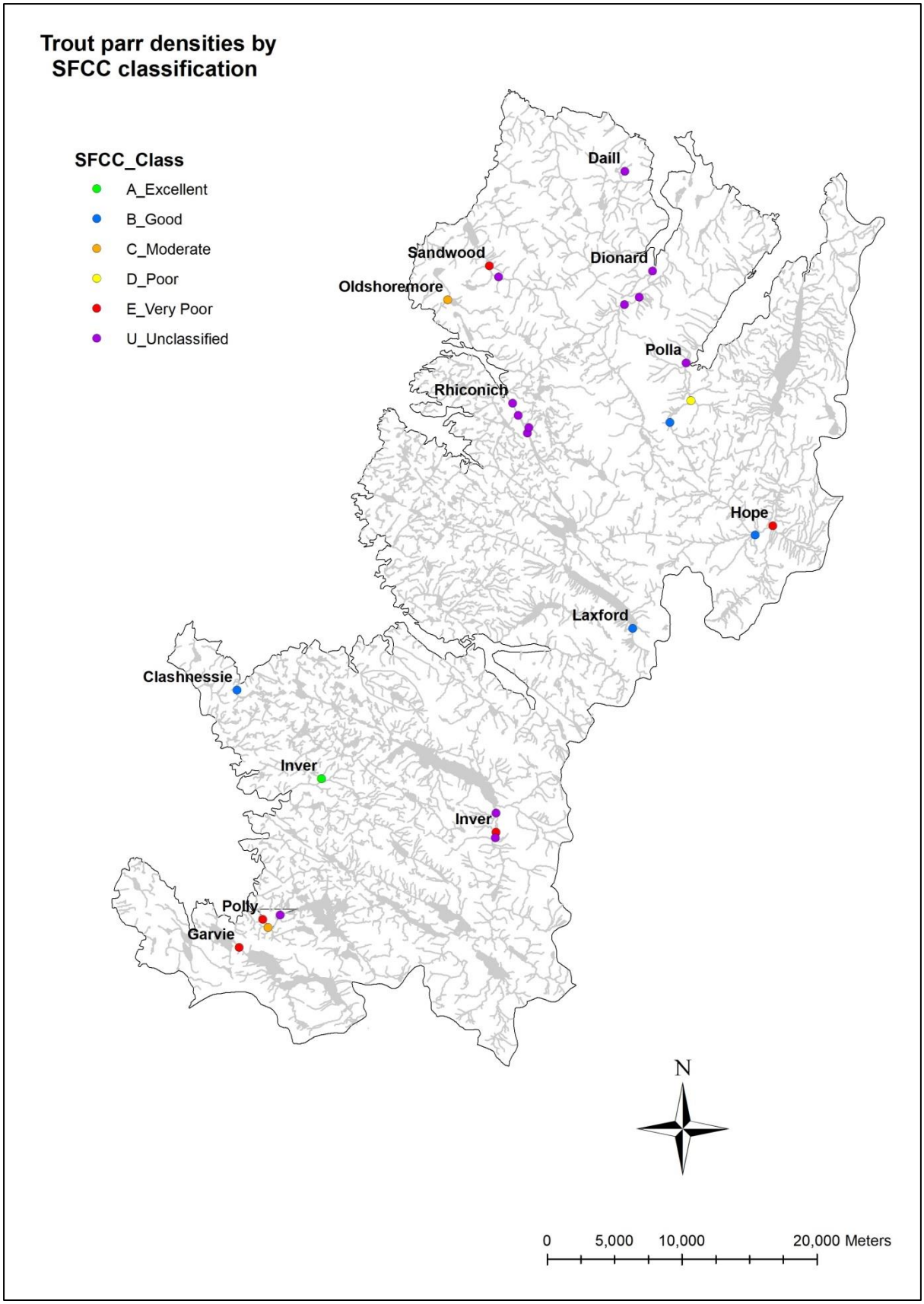

Figure 10: *Trout parr densities according to the SFCC regional classification scheme*

4. Species distribution

Figure 11 shows that salmon were the most commonly occurring species within the 2018 survey sites within the West Sutherland area, and were present within 84% of the sites. This is followed by eels, present in 76% of sites. Trout were present in 73% of the survey sites, where minnows and 3 spined sticklebacks were present in low numbers within 15% and 11% of the sites respectively.

Figure 12 displays species distribution within the survey sites across the West Sutherland area by presence/absence.

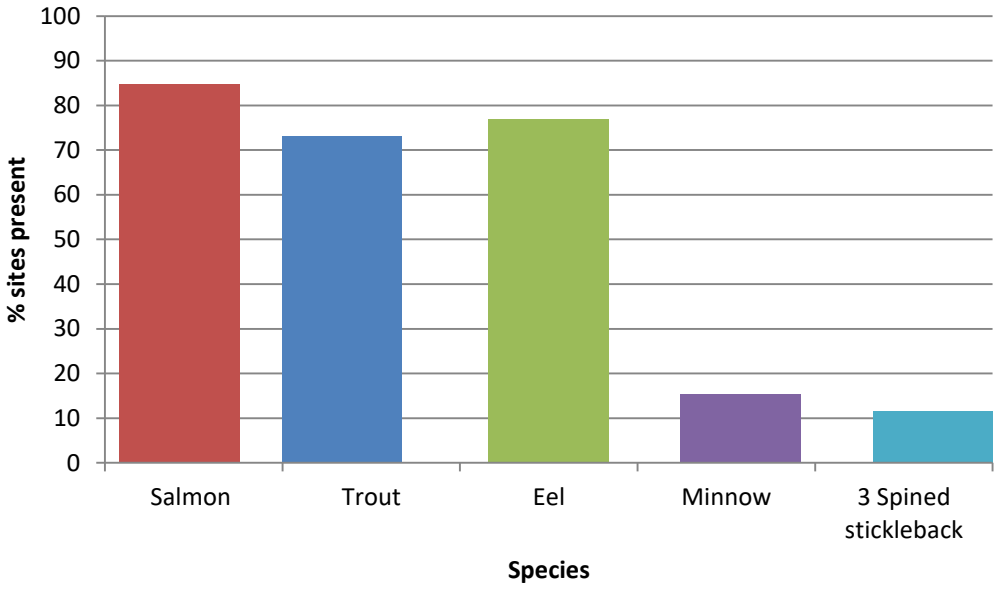

Figure 11: *Species composition within the West Sutherland area*

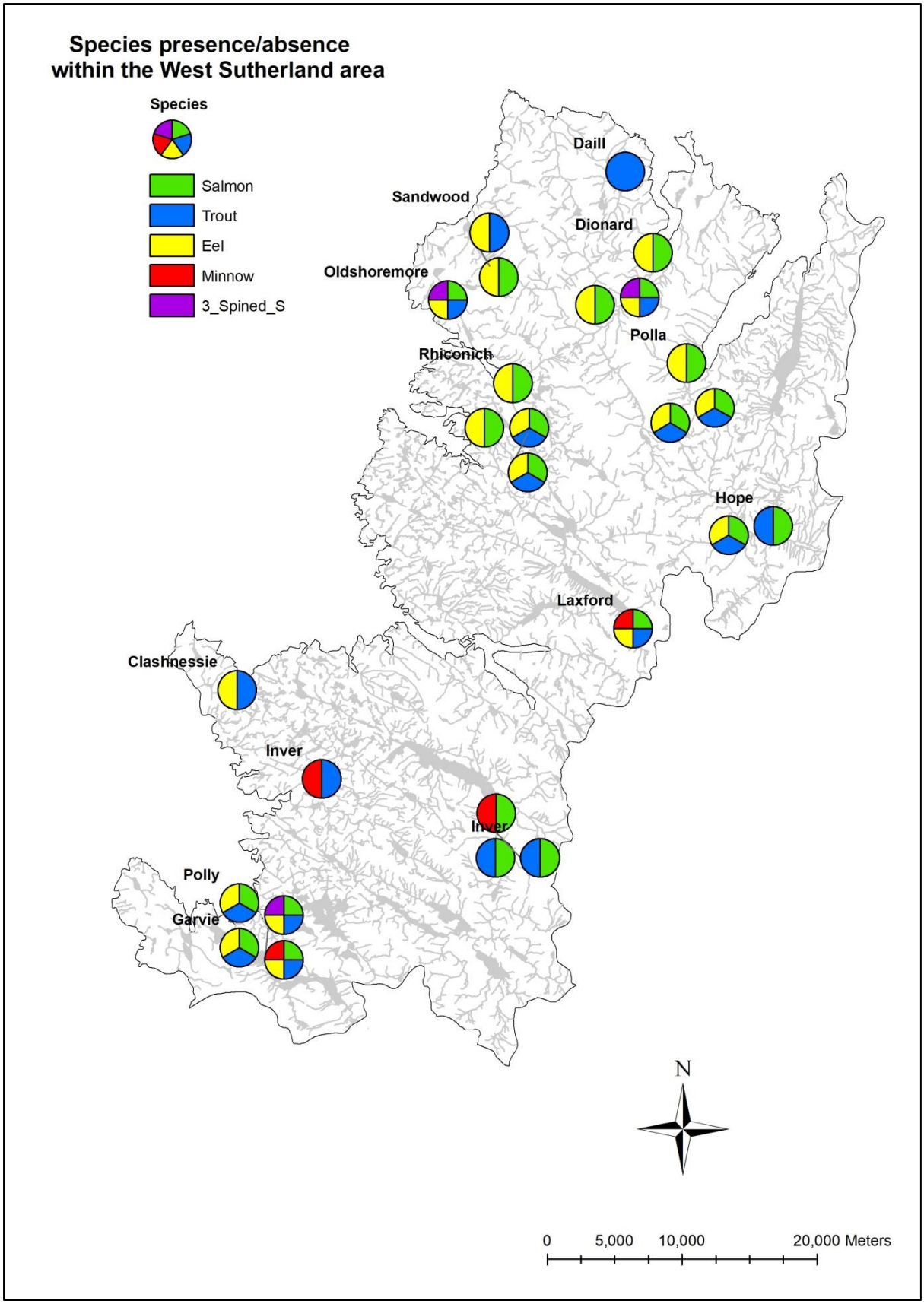

Figure 12: *Species distribution by presence/absence across the West Sutherland area*

5. Discussion

Salmon dominated these surveys in terms of their presence across the survey sites as well as densities within the sites, other than WestSutherland_4549 (Daill catchment), PmusselWestSutherland_029 (Clashnessie catchment), and WestSutherland_4541 (Inver catchment) where no salmon were present. This is likely due to habitat type and accessibility, as salmon will ordinarily out-compete trout within areas where habitat is suitable for both species. The lower trout densities within these surveys do not necessarily reflect a problem with the population itself. Whilst the sites were picked at random the potential presence of salmon and specific river orders were requirements of the study and therefore selection process. This may have biased the site selection to sites more suitable for salmon than trout.

When compared to the SFCC regional classification scheme, trout density grading is largely negative, and within the Dionard system in particular salmon densities appear low within WestSutherland_4511 and WestSutherland_4519. However, this is likely due to habitat type and site selection process as above (in the case of trout) and habitat type and survey site situation in the case of the Dionard sites; these were wide main river stem sites, where escapement is very high during electro-fishing surveys. In addition to this, the sites were very shallow, with fine gravel substrates which provides very poor instream cover. Whilst it was important for the purposes of these surveys to take samples at random areas within the catchments, it should be remembered that these surveys will not necessarily reflect the true juvenile population status of each of the catchments.

The start of the 2018 electro-fishing survey season was extraordinarily warm and dry, with extremely low river levels and water temperatures that were encroaching upon dangerous levels for salmonids. Hence, there were instances where surveys were cancelled due to the danger of fish mortalities due to the additional stress of capture and processing. Conversely, the end of the summer and early autumn was exceptionally wet with high river levels, making surveying difficult. Low river levels can have an effect on fish densities due to fish being forced into smaller areas of water, therefore creating a higher density than that which is normally present within a tributary, for example. During high water, escapement rates are higher due to faster flows and higher likelihood of operator error, due to water clarity and turbulence. While taking this into account, both in cases where factors may have augmented results to reflect higher or lower densities than normally expected, salmon densities appear to be healthy within the major salmon systems.

The high temperatures experienced during the early summer of 2018 do however highlight a need for improved climate control, particularly within salmonid nursery tributaries. Salmonids fare better when water temperatures are stable, and increase/decrease at a natural rate. Planting of broadleaf trees within riparian zones would assist with this due to canopy shading helping to keep water temperatures more stable, and preventing dramatic/rapid temperature fluctuations between extremes.