Kolarctic CBC – Project KO4178; Conserving our Atlantic salmon as a sustainable resource for people in the North; fisheries and conservation in the context of growing threats and a changing environment.

# REPORT III. Summary from the long-term mean monthly river temperatures and monthly cumulative temperatures as an index from the changes in juvenile salmon freshwater environment; graphical illustrations from the temperature variations within and between the rivers in Northern Norway and Finland

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# REPORT III. Summary from the long-term mean monthly river temperatures and monthly cumulative temperatures as an index from the changes in juvenile salmon freshwater environment; graphical illustrations from the temperature variations within and between the rivers in Northern Norway and Finland

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**Abstract**

Mean monthly river temperatures in northernmost Norway show simultaneous fluctuations between the rivers, although the rivers are located in large distances from each other. The biggest distance is between the River Alta (in western Finnmark) and the River Grense Jakobselv (in eastern Finnmark). River Alta is one of the coldest rivers early in the summer, June and July, compared to other large rivers. It can be explained by the large and deep-water magazine above the dam bringing cold water into the River Alta early in the summer. While water in the other rivers is getting colder, which is what normally happens towards autumn, water in the River Alta below the reservoir stays warmer for a longer period in September and October.

Mean temperatures combining the daily values from the months June, July and August of the rivers in Varanger Peninsula between the rivers from Bergebyelv in the east, to Stordalelv (Berlevåg) in the west, had temperatures of 6.8°C-7.4°C in the year 2020. These rivers represent cold rivers. Warm rivers in eastern Finnmark, from the River Vesterelv in the west to the River Grense Jakobselv in the east, had mean temperatures of 11.3°C -13.3°C. In the River Tana watershed, situating far from the coastal areas, mean summer temperatures in salmon running tributaries varied from 7.7°C to 11.5°C. Summer temperatures in small brooks in the River Tana watershed varied from 6.4°C to 12.2°C, which indicates that the type of brooks are differing from each other. Living conditions in terms of water temperature during winter for juvenile salmon are harsh in northern rivers. Daily temperatures are below 1°C for 234 days in a year in Stordalelv (Berlevåg), 239 days in Komagelv, 229 days in Skallelv. The less harsh water temperature conditions in winter are in the rivers Nyelv (145 days below 1°C), Sandneselv (163 days), Syltefjordelv (196 days) and Vetsikkojoki (197 days). Daily water temperatures in summer have an important role in the growth of juvenile salmon. In general, in the rivers with low water temperatures in July and August, juveniles are growing slowly and reaching smolt ages 1-3 years later compared to the smolt ages in warmer rivers.

**Key words:**
River temperatures, juveniles, Atlantic salmon, Salmo salar, Northern Norway, Finland

**Front page photo:**
Eero Niemelä

## Content

1. Table I. Mean water temperatures from three summer months (June, July, August combined) in the years 2019, 2020 and 2021. Source; NVE (Norway), County Governor (Norway), Luke (Finland).

| River | Year 2019 | Year 2020 | Year 2021 |
|---|---|---|---|
| Grense Jakobselv | | 11.6 | |
| Karpelv | 11.4 | 12.9 | 13.6 |
| Sandneselv | | 11.4 | 12.6 |
| Neiden | 12.4 | 13.3 | 14.6 |
| Nyelv | | 11.3 | |
| Vesterelv | | 11.9 | 12.6 |
| Bergebyelv | | 8.9 | |
| Skallelv | | 8.5 | 9.3 |
| Komagelv | | 9.2 | 10.0 |
| Sandfjordelv | | 6.8 | 7.4 |
| Syltefjordelv | | 6.9 | |
| Kongsfjordelv | | 8.9 | 10.1 |
| Stordalelv | | 7.4 | 8.1 |
| Tana | 12.3 | 12.3 | 13.7 |
| Levajoki | 9.0 | 7.7 | 9.3 |
| Kuoppilasjoki | 10.2 | 9.9 | 11.1 |
| Vetsikkojoki | 11.5 | 11.5 | 12.7 |
| Tsarsejoki | 10.2 | 10.1 | 11.5 |
| Vidisjoki | 9.7 | 10.5 | 10.7 |
| Äimäjoki | 7.2 | 6.4 | 7.8 |
| Yläseitikkojoki | 9.9 | 10.1 | 11.0 |
| Rassijoki | 6.6 | 7.8 | 7.5 |
| Puksaljoki | 10.3 | 11.5 | 11.3 |
| Leppäjoki | 11.3 | 12.2 | 13.2 |

## 2. Graphs illustrating mean monthly temperatures and monthly cumulative temperatures within and between large and small rivers

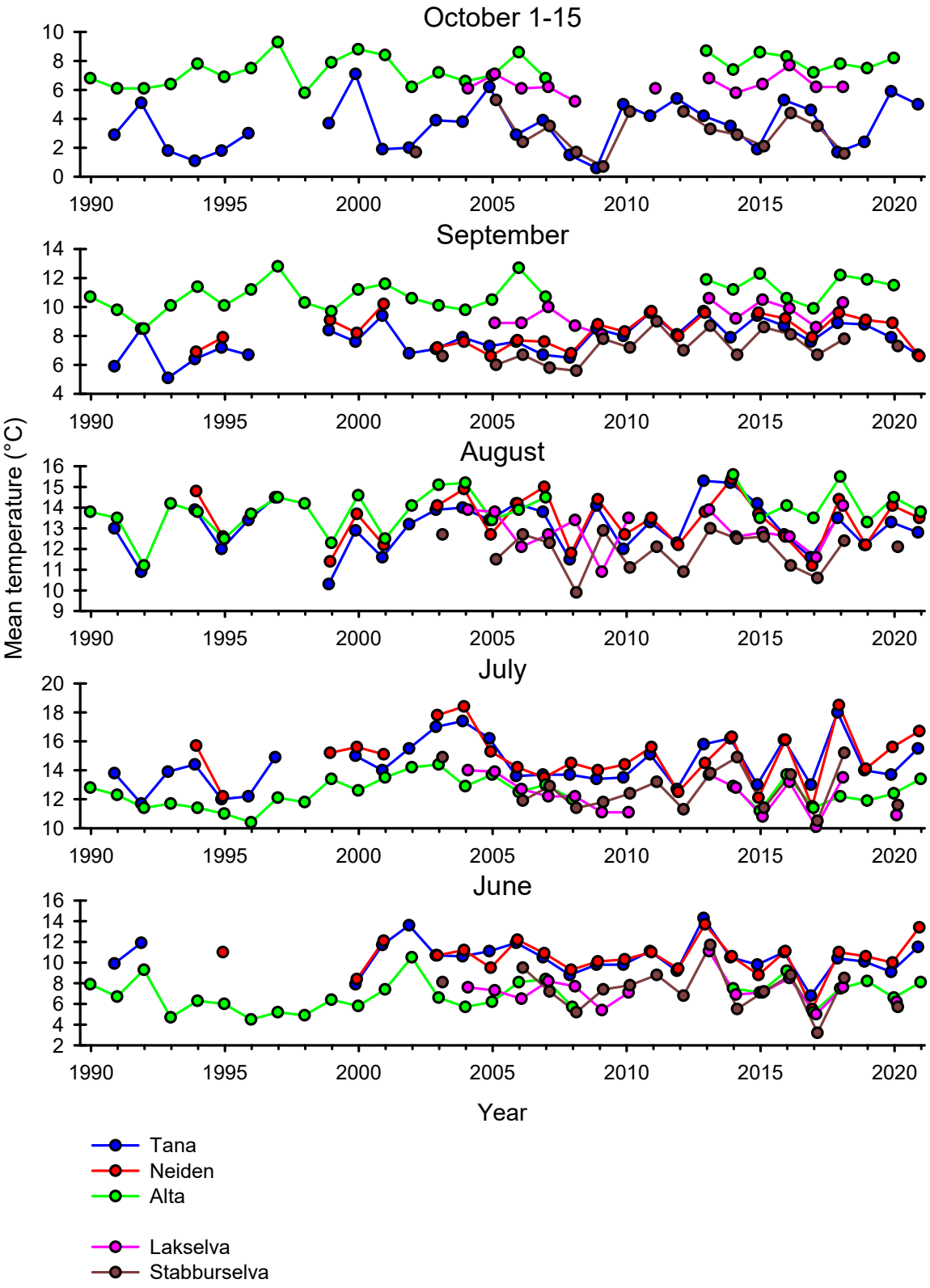


Figure 1. Monthly mean long-term water temperatures in the rivers Tana, Neiden, Alta, Lakselv and Stabburselv. Source; NVE (Norway).

Mean monthly river temperatures in northernmost Norway show simultaneous fluctuations between the rivers, although the rivers are located in large distances from each other. The biggest distance is between the River Alta (in western Finnmark) and the River Grense Jakobselv (in eastern Finnmark). River Alta is one of the coldest rivers early in the summer, June and July, compared to other large rivers. It can be explained by the large and deep-water magazine above the dam bringing cold water into the River Alta early in the summer. While water in the other rivers is getting colder, which is what normally happens towards autumn, water in the River Alta reservoir stays warmer for a longer period in September and October.

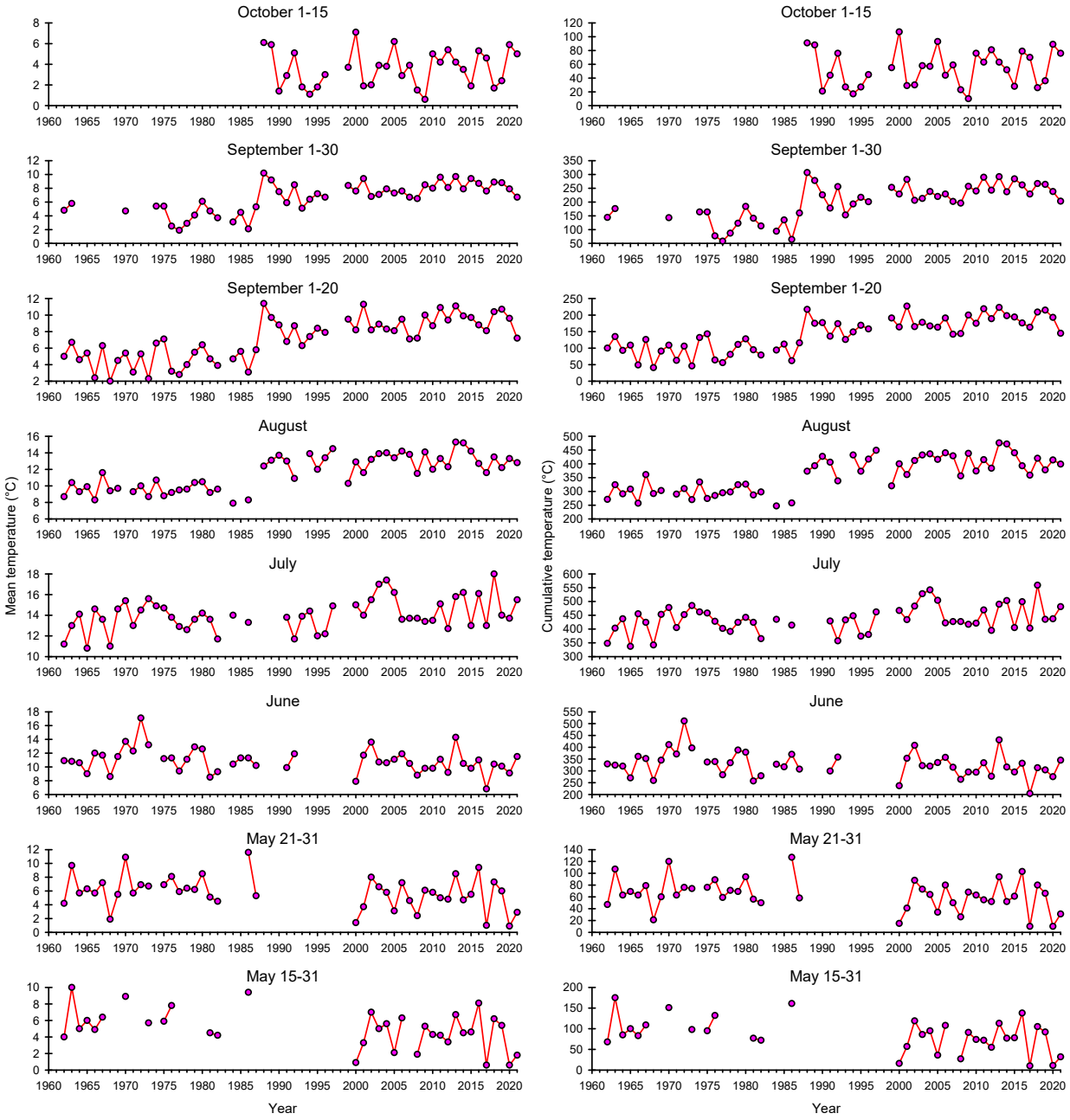


Figure 2. Monthly mean long-term water temperatures (figure on the left) and monthly cumulative temperatures calculated from the mean daily values (figure on the right) in the River Tana. Source; NVE (Norway), Finnish Environment Institute (Finland).

Monthly mean water temperatures and cumulative temperatures in the River Tana have increased especially in August and September compared to earlier years.

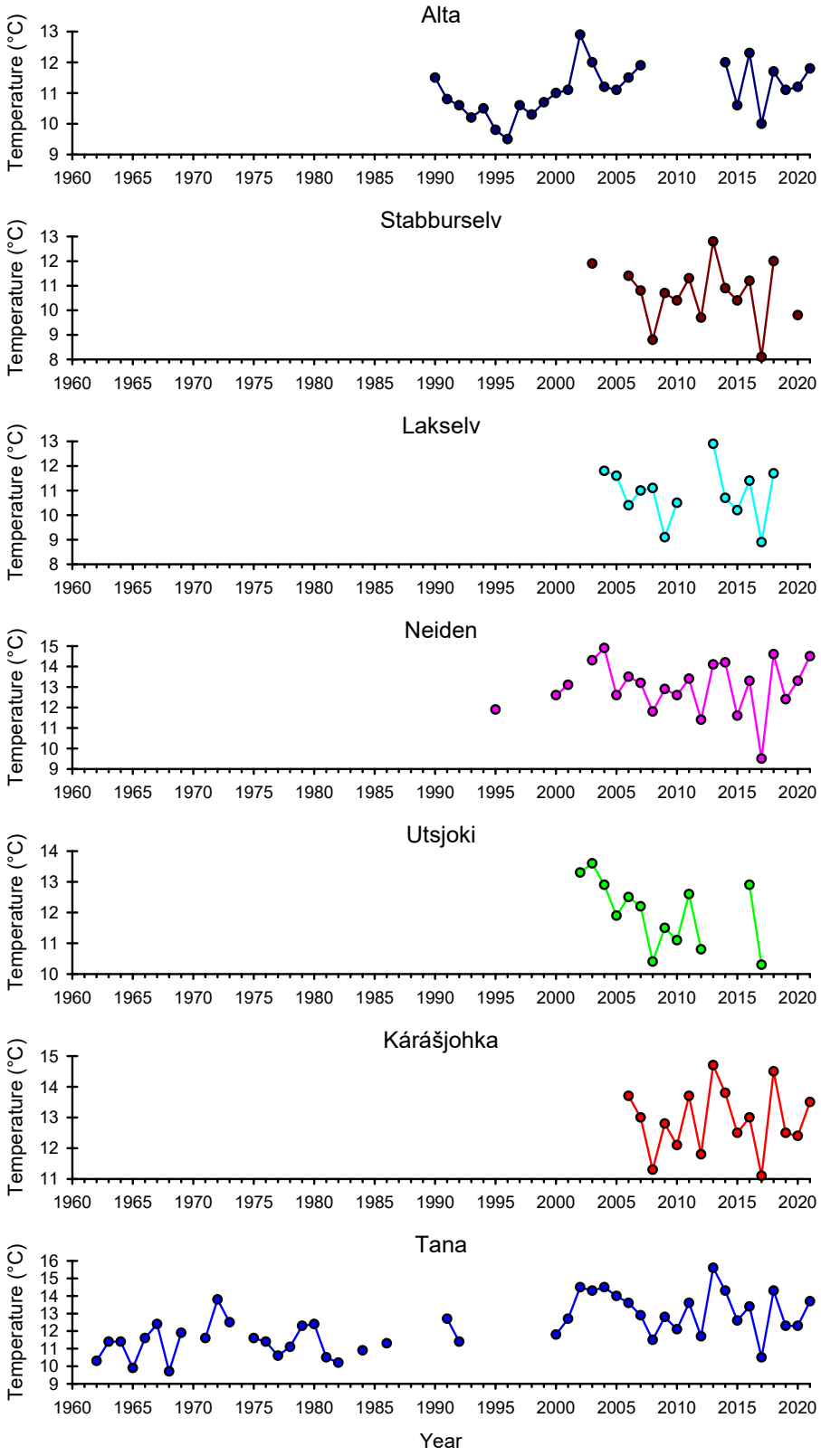


Figure 3. Mean water temperatures for summer months (June, July, August temperatures combined) in seven large salmon rivers in Northern Norway. Source; NVE (Norway), Finnish Environment Institute (Finland), Luke (Finland).

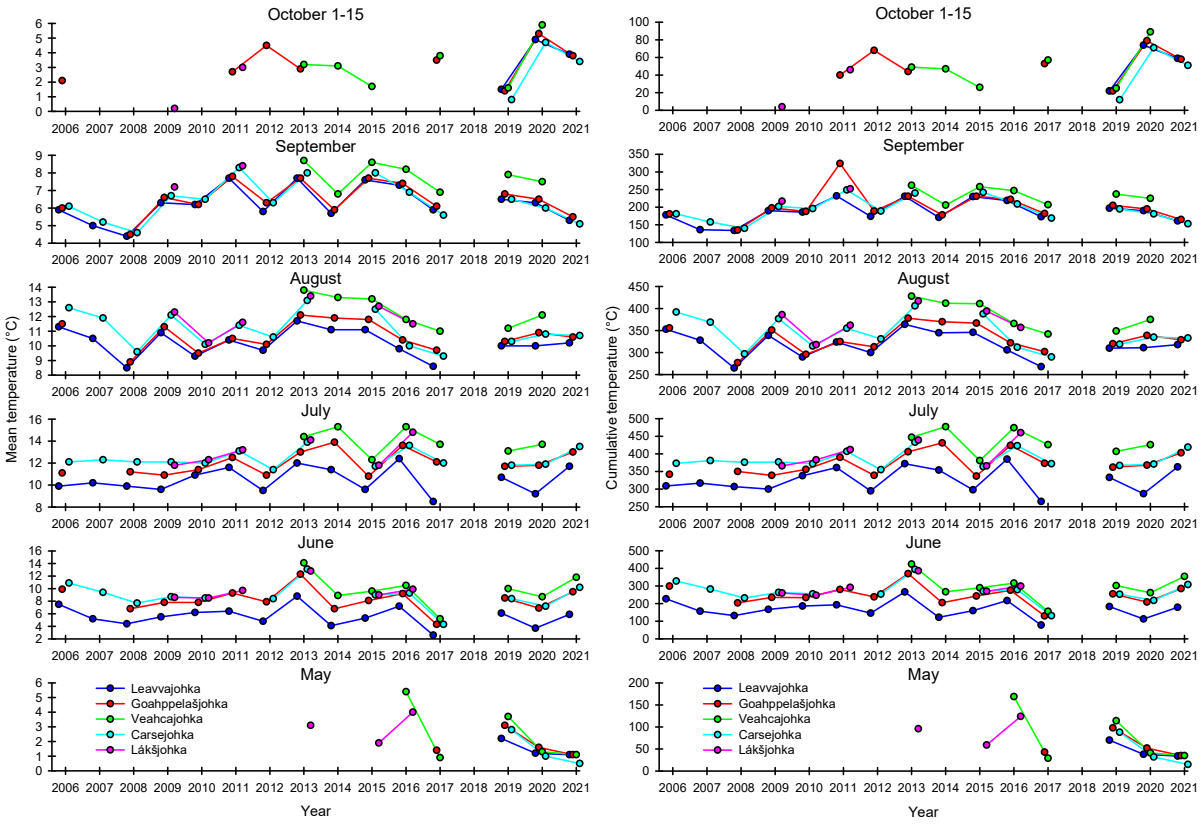


Figure 4. Monthly mean long-term water temperatures and monthly cumulative temperatures (degree days) in salmon tributaries within the River Tana watershed. Source; County Governor (Norway), Luke (Finland).

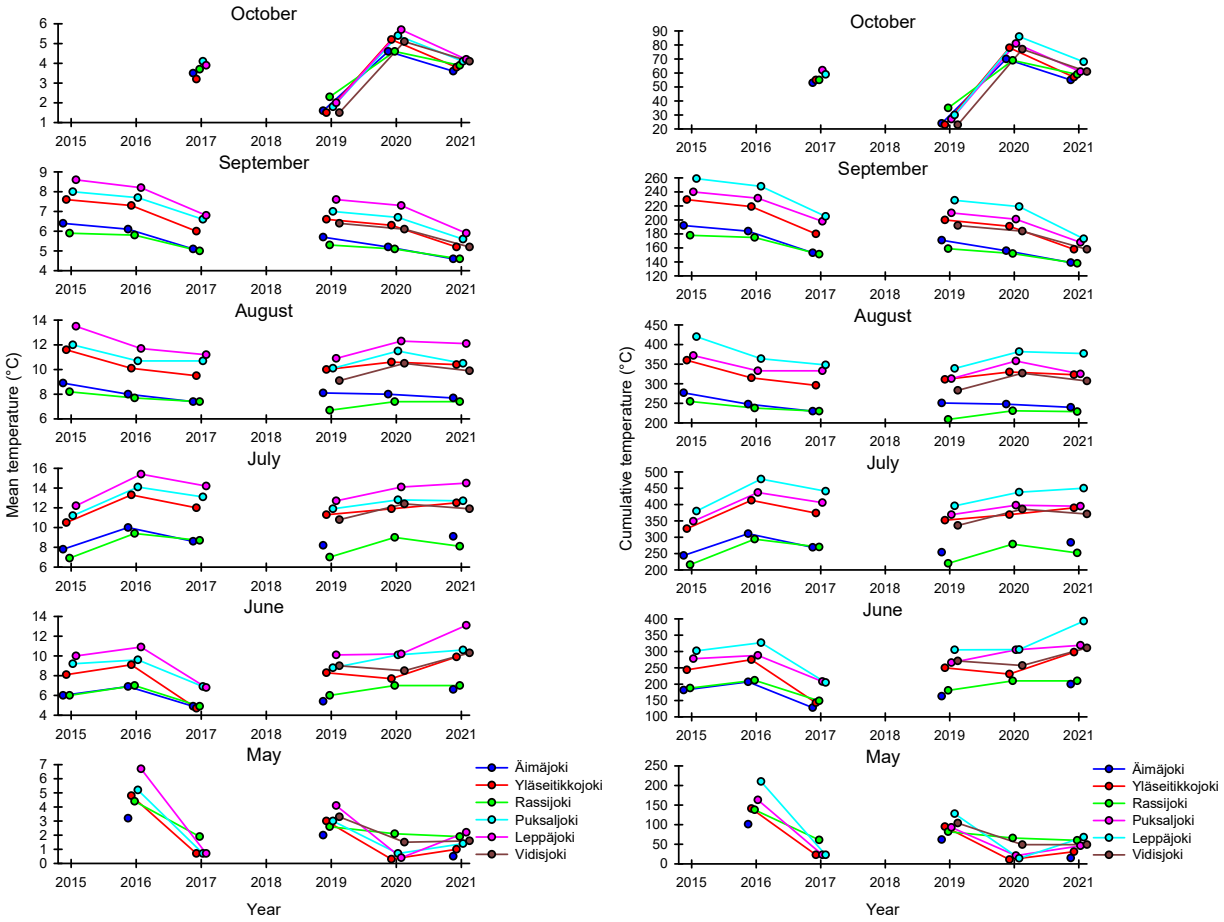


Figure 5. Monthly mean long-term water temperatures and monthly cumulative temperatures (degree days) in small brooks within the River Tana watershed. Source; County Governor (Norway), Luke (Finland).

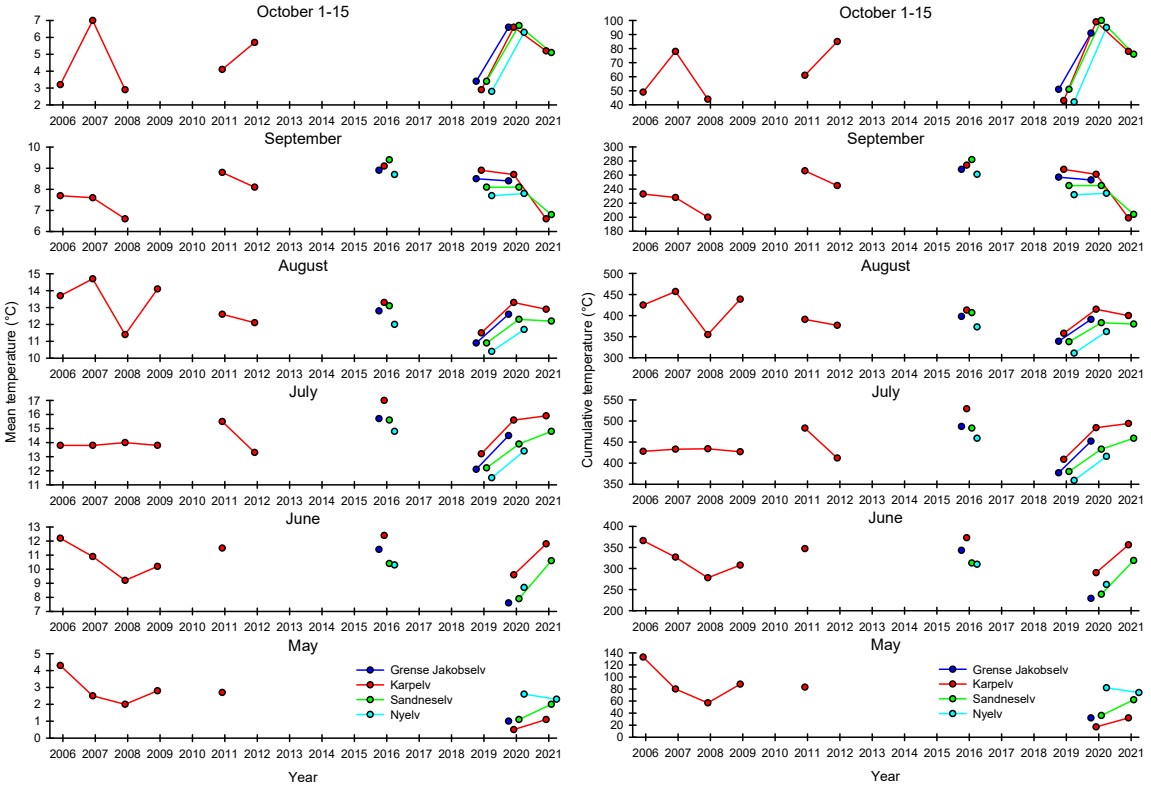


Figure 6. Monthly mean long-term water temperatures and monthly cumulative temperatures (degree days) in salmon rivers within southern Varangerfjord. Source; NVE (Norway), County Governor (Norway).

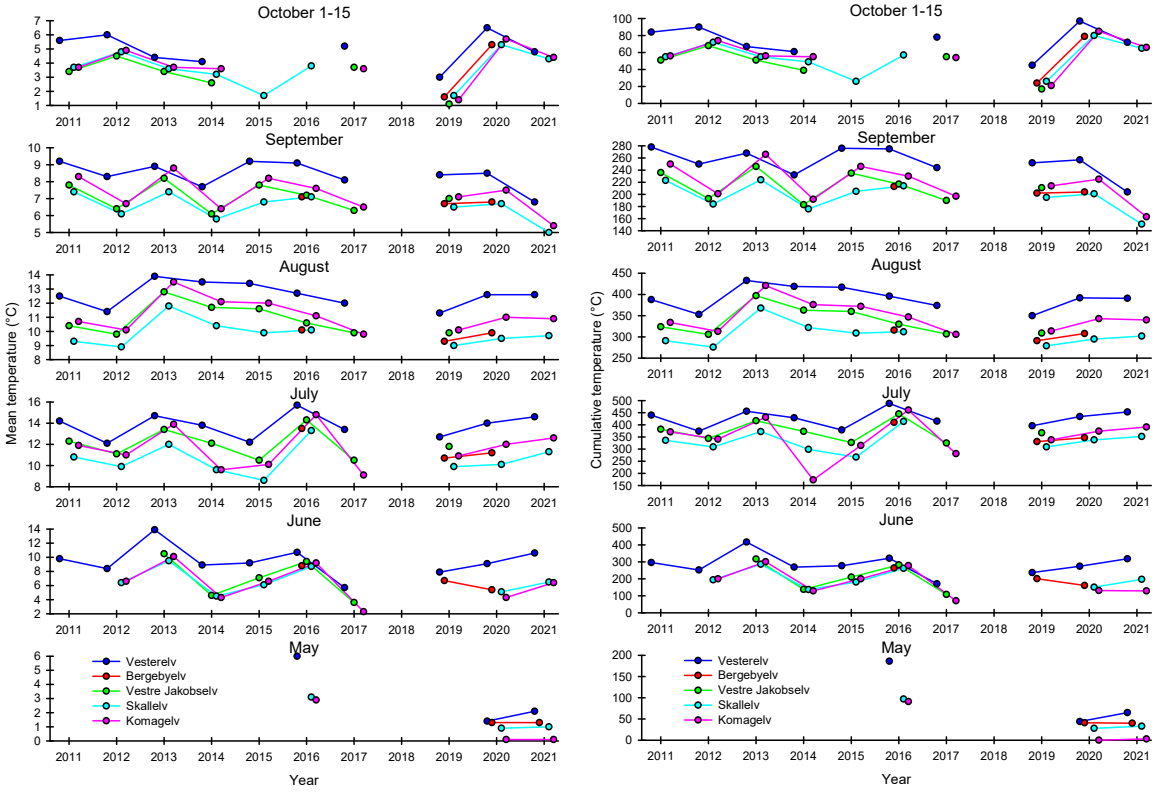


Figure 7. Monthly mean long-term water temperatures and monthly cumulative temperatures (degree days) in salmon rivers within northern Varangerfjord, Source; County Governor (Norway).

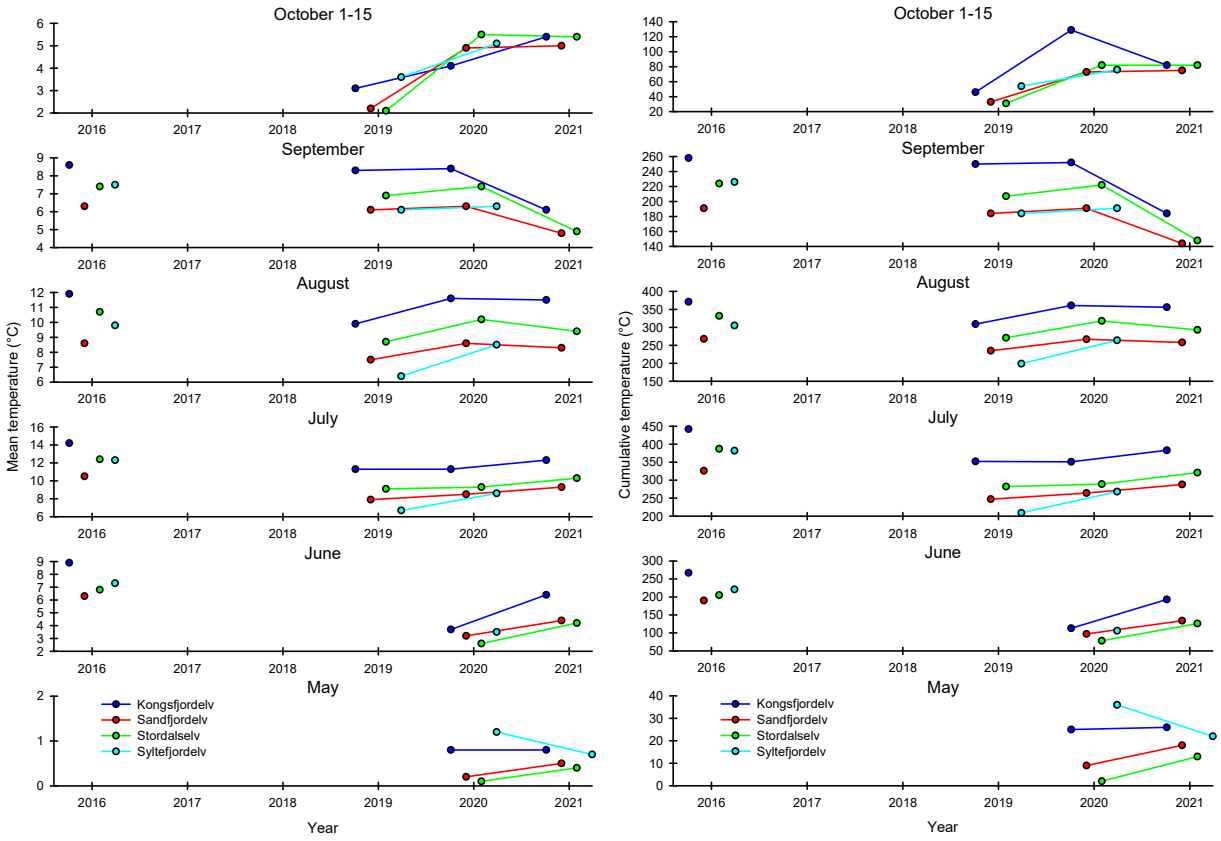


Figure 8. Monthly mean long-term water temperatures and monthly cumulative temperatures (degree days) in salmon rivers within northern Finnmark. Source; County Governor (Norway).

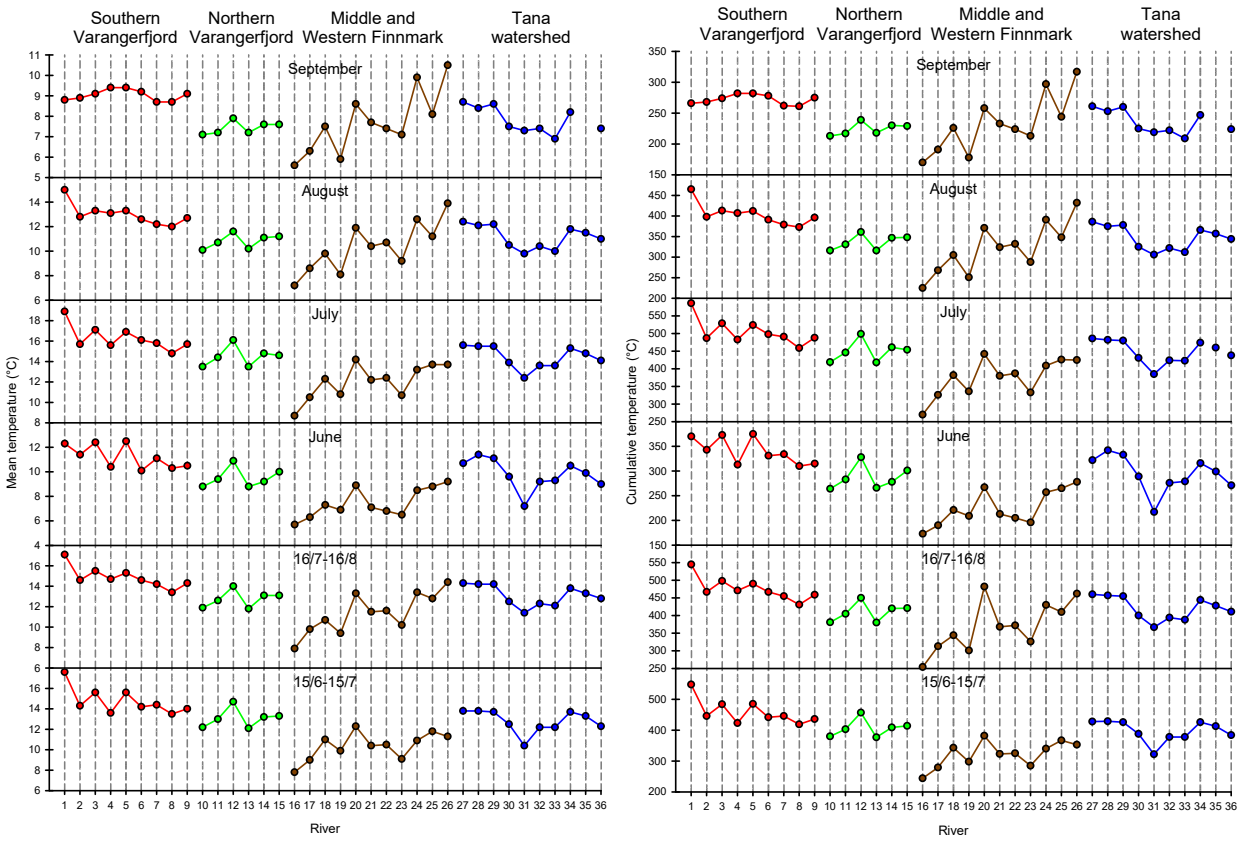


Figure 9. Monthly mean water temperatures and monthly cumulative temperatures (degree days) in 35 salmon rivers in Northern Norway and Finland in the year 2016. Rivers in the figure are: Ponoi (1), Grense Jakobselv (2), Karpelv (3), Sandneselv (4), Munkelv (5), Neiden (6), Klokkerelv (7), Nyelv (8), Vesterelv Nesseby (9), Bergebyelv (10), Vestre Jakobselv (11), Storelv Vadsö (12), Skallelv (13), Komagelv (14), Kramvikelv(15), Vesterelv (Hamningberg) (16), Sandfjordelv (17), Syltefjordelv (18), Storelv (Båtsfjord) (19), Kongsfjordelv (20), Östre Risfjordelv (21), Stordalselv (22), Julelv (23), Lakselv (24), Stabburselv (25), Alta (26), Tana (27), Karasjohka (28), Iesjohka (29), Baisjohka (30), Leavvajohka (31), Kuoppilasjoki (32), Tsarsejoki (33), Vetsikkojoki (34), Laksjohka (35), Luftjohka (36). Colours in the graphs are indicating the geographical situation of the rivers: Red color are rivers east from Vesterelv in SouthernVarangerfjord, Green color are rivers in Northern Varangerfjord; Brown color are rivers from Northern Varanger Peninsula to Altafjord, Blue color are rivers in Tana watershed. Source; NVE (Norway), County Governor (Norway), Luke (Finland).

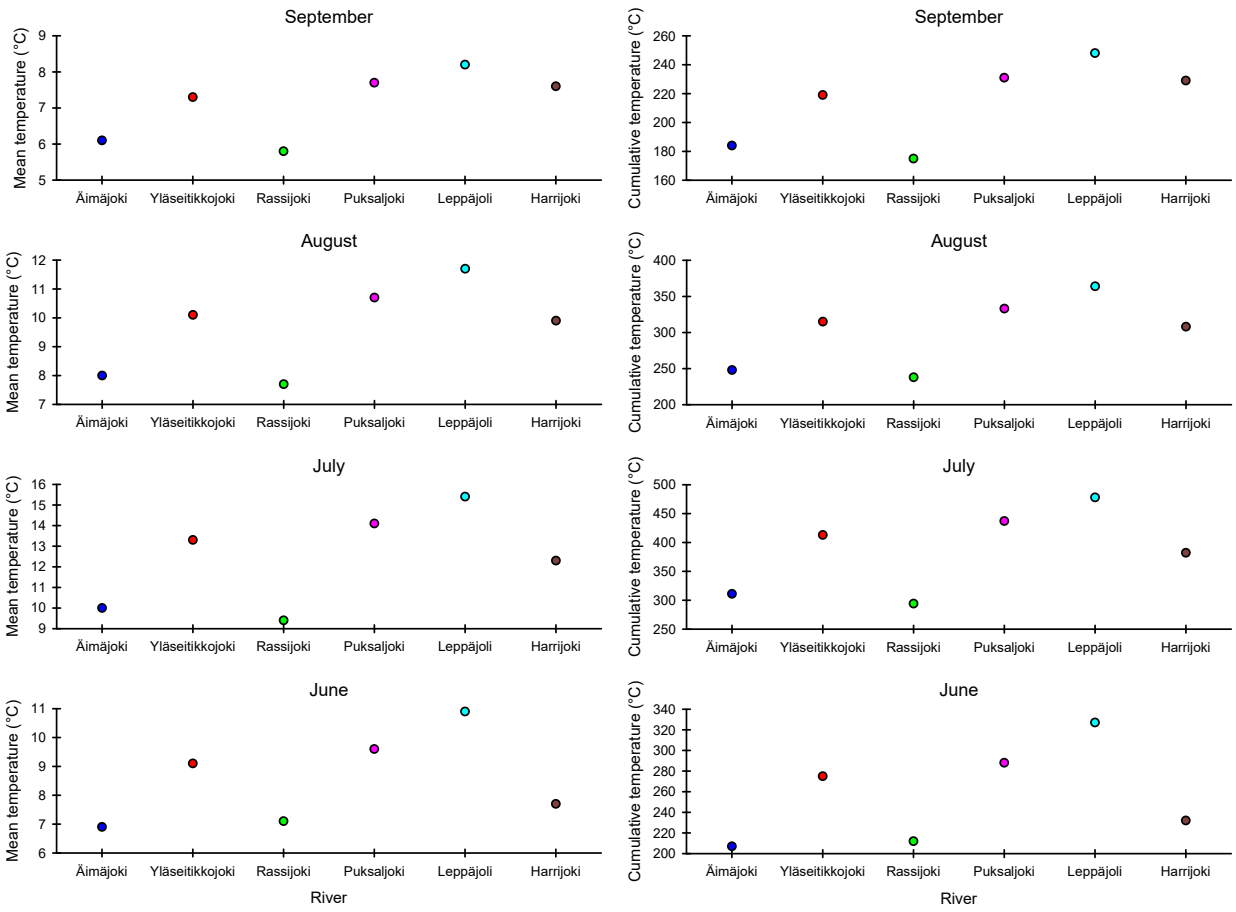


Figure 10. Monthly mean water temperatures and monthly cumulative temperatures (degree days) in brooks in the River Tana watershed in the year 2016. Source; County Governor (Norway), Luke (Finland).

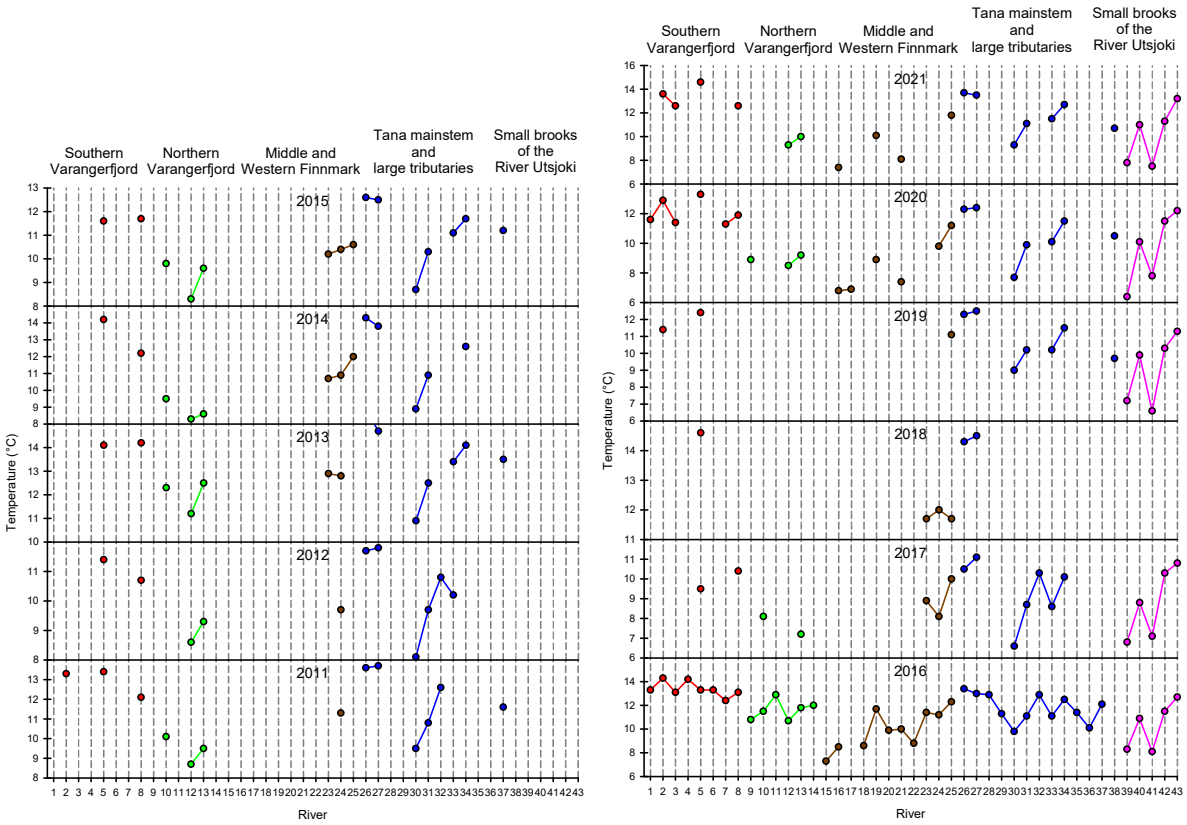


Figure 11. Summer mean temperatures (June, July, August combined) in Northern Norway and in Finland in the years 2011-2021. Rivers in the figure are: Grense Jakobselv (1), Karpelv (2), Sandneselv (3), Munkelv (4), Neiden (5), Klokkerelv (6), Nyelv (7), Vesterelv Nesseby (8), Bergebyelv (9), Vestre Jakobselv (10), Storelv (Vadsø) (11), Skallelv (12), Komagelv (13), Kramvikelv(14), Vesterelv (Hamningberg) (15), Sandfjordelv (16), Syltefjordelv (17), Storelv (Båtsfjord) (18), Kongsfjordelv (19), Østre Risfjordelv (20), Stordalselv (21), Julelv (22), Lakselv (23), Stabburselv (24), Alta (25), Tana (26), Karasjohka (27), Iesjohka (28), Baisjohka (29), Leavvajohka (30), Kuoppilasjoki (31), Utsjoki (32), Tsarsejoki (33), Vetsikkojoki (34), Luftjohka (35), Harrjohka (36) Laksjohka (37), Vidisjoki (38), Äimäjoki (39), Yläseitikkojoki (40), Rassijoki (41), Puksaljoki (42), Leppäjoki (43). Source; NVE (Norway), County Governor (Norway), Luke (Finland).

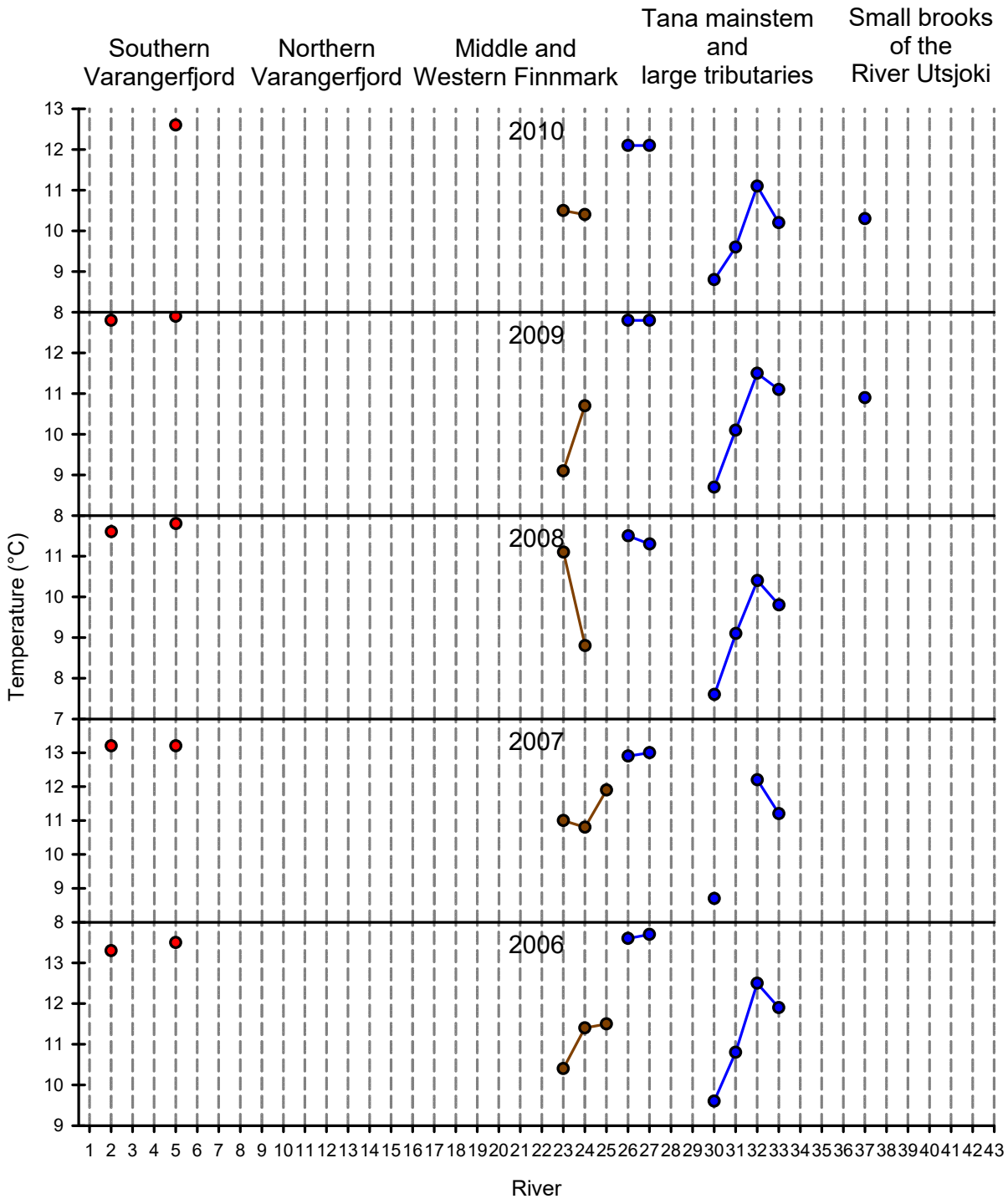


Figure 12. Summer mean temperatures (June, July, August combined) in Northern Norway and in Finland in the years 2006-2010. Rivers in the figure are: Grense Jakobselv (1), Karpelv (2), Sandneselv (3), Munkelv (4), Neiden (5), Klokkerelv (6), Nyelv (7), Vesterelv Nesseby (8), Bergebyelv (9), Vestre Jakobselv (10), Storelv Vadsø (11), Skallelv (12), Komagelv (13), Kramvikelv(14), Vesterelv (Hamningberg) (15), Sandfjordelv (16), Syltefjordelv (17), Storelv (Båtsfjord) (18), Kongsfjordelv (19), Østre Risfjordelv (20), Stordalselv (21), Julelv (22), Lakselv (23), Stabburselv (24), Alta (25), Tana (26), Karasjohka (27), Iesjohka (28), Baisjohka (29), Leavvajohka (30), Kuoppilasjoki (31), Utsjoki (32), Tsarsejoki (33), Vetsikkojoki (34), Luftjohka (35), Harrjohka (36) Laksjohka (37), Vidisjohka (38), Äimäjoki (39), Yläseitikkojoki (40), Rassijoki (41), Puksaljoki (42), Leppäjoki (43). Source; NVE (Norway), County Governor (Norway), Luke (Finland).

## 3. Cumulative temperatures from late summer to the following summer indicating the egg development period

Table II. Cumulative water temperatures (degree days) from the expected spawning dates of pink salmon (10. and 20. August in the year 2019 and in the year 2020) to the end of the same year, to the end of May in the following year (2020 and 2021) and to the 15. June in the following year (2020 and 2021). The cumulative water degree days are affecting into the development of eggs to eyed-egg stage and to the hatching period of eggs to yolk-sac alevins. Pink salmon eggs need 350-400 degree days counting from the fertilization date to reach the eyed-egg stage date, 550-650 degree days from the fertilization date to hatch from the eggs (and start to use yolk-sac energy), 900-950 days from the fertilization date to emerge from the spawning gravel to the upper layers of gravel in the river bottom. Source; NVE (Norway), County Governor (Norway), Luke (Finland), VNIRO (Russia).

| River | Spawning on 10. August in 2019 (2020) and degree days until 31. December 2019 (2020) | Spawning on 20. August in 2019 (2020) and degree days until 31. December 2019 (2020) | Spawning on 10. August in 2019 (2020) and degree days until 31. May in 2020 (2021) | Spawning on 20 August in 2019 (2020) and degree days until 31. May in 2020 (2021) | Spawning on 10. August in 2019 (2020) and degree days until 15. June in 2020 (2021) | Spawning on 20. August in 2019 (2020) and degree days until 15. June in 2020 (2021) |
|---|---|---|---|---|---|---|
| Grense Jakobselv | 573,(676) | 464, (552) | 619 | 511 | 687 | 579 |
| Karpelv | 586, (678) | 471, (548) | 603, (710) | 489, (580) | 708, (865) | 593, (735) |
| Sandneselv | 563, (663) | 453, (544) | 605, (735) | 496, (616) | 685 | 579 |
| Neiden | 592, (672) | 474, (533) | 639, (738) | 521, (599) | 747, (922) | 629, (783) |
| Nyelv | 533, (624) | 430, (508) | 678 | 575 | 778 | 675 |
| Vesterelv | 562, (649) | 448, (525) | 605, (714) | 490, (590) | 707, (853) | 593, (730) |
| Bergebyelv | 454, (514) | 359, (416) | 509, (569) | 415, (470) | 562 | 467 |
| Vestre Jakobselv | 462 | 361 | 539 | 439 | 575 | 474 |
| Skallelv | 432, (509) | 342, (418) | 462, (548) | 372, (456) | 511, (620) | 421, (529) |
| Komagelv | 472, (562) | 369, (456) | 472, (572) | 370, (466) | 504, (635) | 402, (529) |
| Sandfjorelv | 395, (487) | 319, (403) | 404, (505) | 328, (421) | 433, (548) | 358, (464) |
| Syltefjordelv | 421 | 358 | 457 | 395 | 488 | 425 |
| Kongsfjordelv | 561, (642) | 466, (530) | 608, (692) | 513, (580) | 634, (750) | 539, (538) |
| Stordalelv | 449, (560) | 364, (462) | 452, (590) | 364, (492) | 474, (622) | 389, (523) |
| Tana | 570, (587) | 454, (463) | 584, (620) | 468, (496) | 681, (781) | 564, (657) |
| Leavvajohka | 453, (481) | 353, (385) | 502, (530) | 402, (435) | 531, (592) | 431, (497) |
| Kuoppilasjohka | 471, (502) | 365, (399) | 535, (551) | 429, (448) | 596, (680) | 490, (646) |
| Veahtsajohka | 527, (576) | 413, (461) | 579, (624) | 465, (509) | 661, (800) | 547, (685) |
| Tsarsejohka | 448, (474) | 342, (372) | 481, (489) | 374, (387) | 542, (638) | 436, (536) |

Table III. Cumulative water temperatures (degree days) in salmon rivers in Northern Norway and in the River Tana watershed from the expected spawning dates of Atlantic salmon (20. September, 25. September, 5. October in the year 2019) onwards to the end of May, to 15. of June and to 15. July in the following year (2020). The cumulative water degree days are affecting into the development of eggs to eyed-egg stage and to the hatching period of eggs to yolk-sac alevins. Source; NVE (Norway), County Governor (Norway), Luke (Finland)

| | Spawning on 20. September in 2019 and degree days until 31. May 2020 | Spawning on 25. September in 2019 and degree days until 31. May 2020 | Spawning on 5. October in 2019 and degree days until 31. May in 2020 | Spawning on 20. September in 2019 and degree days until 15. June 2020 | Spawning on 25. September in 2019 and degree days until 15. June 2020 | Spawning on 5. October in 2019 and degree days until 15. June in 2020 | Spawning on 20. September in 2019 and degree days until 15. July in 2020 | Spawning on 25. September in 2019 and degree days until 15. July in 2020 | Spawning on 5. October in 2019 and degree days until 15. July in 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Grense Jakobselv | 168 | 141 | 90 | 398 | 370 | 319 | 583 | 555 | 504 |
| Karpelv | 127 | 100 | 51 | 418 | 391 | 342 | 614 | 587 | 538 |
| Neiden | 141 | 117 | 73 | 442 | 418 | 375 | 634 | 610 | 567 |
| Vesterelv | 146 | 123 | 78 | 420 | 397 | 352 | 597 | 575 | 529 |
| Bergebyelv | 131 | 114 | 80 | 293 | 276 | 242 | 429 | 413 | 379 |
| Vestre Jakobselv | 136 | 121 | 88 | | | | | | |
| Skallelv | 98 | 82 | 49 | 250 | 234 | 201 | 385 | 369 | 336 |
| Komagelv | 63 | 47 | 14 | 194 | 179 | 145 | 335 | 319 | 286 |
| Sandfjorelv | 87 | 68 | 33 | 185 | 166 | 131 | 284 | 264 | 230 |
| Syltefjordelv | 184 | 158 | 113 | 291 | 265 | 220 | 393 | 367 | 322 |
| Kongsfjordelv | 179 | 156 | 111 | 293 | 269 | 224 | 420 | 396 | 351 |
| Stordalelv | 81 | 63 | 27 | 160 | 142 | 106 | 258 | 240 | 205 |
| Tana | 106 | 81 | 38 | 380 | 355 | 312 | 550 | 525 | 481 |
| Leavvajohka | 114 | 99 | 66 | 227 | 212 | 180 | 334 | 319 | 286 |
| Kuoppilasjohka | 130 | 115 | 83 | 340 | 324 | 292 | 486 | 470 | 438 |
| Veahtsajohka | 126 | 107 | 71 | 389 | 370 | 334 | 561 | 542 | 506 |
| Tsarsejohka | 80 | 67 | 40 | 298 | 285 | 258 | 447 | 434 | 407 |

Table IV. The length of cold-water periods in northern rivers from late autumn to late spring (number of days below 5°C and below 1°C) and the mean water temperature when it was below 1°C. Source; NVE (Norway), County Governor (Norway), Luke (Finland).

| River | Period during winter when mean daily water temperature is below 5°C | | | Period during winter when mean daily water temperature is below 1°C | | |
|---|---|---|---|---|---|---|
| | Start of cold period in autumn (below 5°C) | Stop of cold period in early summer (below 5°C) | Duration of cold period (below 5 °C ) in days | Start of cold period in autumn (below 1°C) | Stop of cold period in early summer (below 1°C) | Duration of cold period in days and mean temperature |
| Grense Jakobselv | 2.10.2019 | 9.6.2020 | 252 days | 18.10.2019 | 25.5.2020 | 221 days, 0.19 °C |
| Karpelv | 1.10.2019 | 2.6.2020 | 246 days | 17.10.2020 | 20.5.2020 | 217 days, 0.03 °C |
| Karpelv | 14.10.2020 | 1.6.2021 | 231 days | 18.10.2020 | 22.5.2021 | 217 days, 0.11 °C |
| Sandneselv | 19.9.2019 | 7.6.2020 | 263 days | 19.10.2019 | 11.5.2020 | 206 days, 0.07 °C |
| Sandneselv | 14.10.2020 | 1.6.2021 | 231 days | 20.11.2020 | 1.5.2021 | 163 days, 0.12 °C |
| Neiden | 22.9.2019 | 1.6.2020 | 253 days, | 15.10.2019 | 20.5.2020 | 218 days, 0.13°C |
| Neiden | 14.10.2020 | 30.5.2021 | 229 days, | 18.10.2020 | 11.5.2021 | 206 days, 0.10°C |
| Nyelv | 19.9.2019 | 4.6.2020 | 260 days | 17.10.2019 | 12.4.2020 | 179 days, 0.33 °C |
| Nyelv | 13.10.2020 | 30.5.2021 | 229 days | 30.10.2020 | 23.3.2021 | 145 days, 0.40 °C |
| Vesterelv | 29.9.2019 | 5.6.2020 | 250 days | 17.10.2019 | 19.5.2020 | 216 days, 0.05 °C |
| Vesterelv | 13.10.2020 | 31.5.2021 | 231 days | 7.11.2020 | 7.5.2021 | 182 days, 0.04 °C |
| Bergebyelv | 18.9.2019 | 12.6.2020 | 269 days | 12.10.2019 | 16.5.2020 | 218 days, 0.16 °C |
| Bergebyelv | 13.10.2020 | 7.6.2021 | 238 days | 17.10.2020 | 12.5.2021 | 208 days, 0.18 °C |
| Vestre Jakobselv | 18.9.2019 | 12.6.2020 | 268 days | 11.10.2019 | 30.4.2020 | 203 days, 0.19 °C |
| Skallelv | 18.9.2019 | 16.6.2020 | 273 days | 15.10.2019 | 30.5.2020 | 229 days, 0.13 °C |
| Skallelv | 13.10.2020 | 7.6.2021 | 238 days | 17.11.2020 | 22.5.2021 | 217 days, 0.19 °C |
| Komagelv | 18.9.2019 | 16.6.2020 | 273 days | 11.10.2019 | 5.6.2020 | 239 days, 0.00 °C |
| Komagelv | 13.10.2020 | 15.6.2021 | 246 days | 17.10.2020 | 31.5.2021 | 227 days, 0.10 °C |
| Sandfjordelv | 17.9.2019 | 1.7.2020 | 289 days | 16.10.2019 | 25.5.2020 | 223 days, 0.09 °C |
| Sandfjordelv | 12.10.2020 | 18.6.2021 | 250 days | 17.10.2020 | 22.5.2021 | 218 days, 0.07 °C |
| Syltefjordelv | 28.9.2019 | 20.6.2020 | 267 days | 1.11.2019 | 14.5.2020 | 196 days, 0.02 °C |
| Kongsfjordelv | 22.9.2019 | 20.6.2020 | 273 days | 28.10.2019 | 16.5.2020 | 202 days, 0.22 °C |
| Kongsfjordelv | 14.10.2020 | 8.6.2021 | 238 days | 29.10.2020 | 3.6.2021 | 218 days, 0.31 °C |
| Stordalelv | 18.9.2019 | 2.7.2020 | 289 days | 14.10.2019 | 3.6.2020 | 234 days, 0.01 °C |
| Stordalelv | 13.10.2020 | 19.6.2021 | 250 days | 17.10.2020 | 3.6.2021 | 230 days, 0.27 °C |
| Tana | 30.9.2019 | 2.6.2020 | 246 days | 17.10.2019 | 25.5.2020 | 221 days, 0.01 °C |
| Tana | 13.10.2020 | 30.5.2021 | 230 days | 18.10.2020 | 23.5.2021 | 218 days, 0.01 °C |
| Kuoppilasjoki | 18.9.2019 | 10.6.2020 | 267 days | 12.10.2019 | 10.5.2020 | 212 days, 0.12 °C |
| Kuoppilasjoki | 12.10.2020 | 2.6.2021 | 234 days | 16.10.2020 | 22.5.2021 | 219 days, 0.15 °C |
| Levajohka | 18.9.2019 | 19.6.2020 | 276 days | 11.10.2019 | 13.5.2020 | 216 days, 0.12 °C |
| Levajohka | 12.10.2020 | 7.6.2021 | 239 days | 20.10.2020 | 23.5.2021 | 216 days, 0.18 °C |
| Vetsikkojoki | 19.9.2019 | 8.6.2020 | 264 days | 13.10.2019 | 26.4.2020 | 197 days, 0.03 °C |
| Vetsikkojoki | 13.10.2020 | 30.5.2021 | 230 days | 17.10.2020 | 23.5.2021 | 219 days, 0.13 °C |
| Tsarsejoki | 15.9.2019 | 9.6.2020 | 268 days | 2.10.2019 | 16.5.2020 | 228 days, 0.01 °C |
| Tsarsejoki | 12.10.2020 | 1.6.2021 | 233 days | 14.10.2020 | 23.5.2021 | 222 days. 0.01 °C |
| Vidisjoki | 18.9.2019 | 7.6.2020 | 263 days | 12.10.2019 | 1.5.2020 | 203 days, 0.16 °C |
| Vidisjoki | 12.10.2020 | 1.6.2021 | 233 days | 17.10.2020 | 15.4.2021 | 181 days, 0.17 °C |
| Äimäjoki | 15.9.2019 | 21.6.2020 | 280 days | 12.10.2019 | 17.6.2020 | 246 days, 0.21 °C |
| Äimäjoki | 12.10.2020 | 2.6.2021 | 234 days | 17.10.2020 | 24.5.2021 | 219 days, 0.09 °C |
| Yläseitikkojoki | 18.9.2019 | 8.6.2020 | 264 days | 12.10.2019 | 31.5.2020 | 233 days, 0.25 °C |
| Yläseitikkojoki | 11.10.2020 | 1.6.2021 | 234 days | 16.10.2020 | 22.5.2021 | 219 days. 0.41 °C |
| Rassijoki | 15.9.2019 | 4.6.2020 | 263 days | 19.10.2019 | 12.4.2020 | 177 days, 0.46 °C |
| Rassijoki | 16.9.2020 | 1.6.2021 | 259 days | 19.11.2020 | 15.4.2021 | 148 days, 0.61 °C |
| Puksaljoki | 18.9.2019 | 1.6.2020 | 257 days | 17.10.2019 | 27.5.2020 | 224 days , 0.12 °C |
| Puksaljoki | 12.10.2020 | 30.5.2021 | 231 days | 18.10.2020 | 16.5.2021 | 212 days, 0.19 °C |
| Leppäjoki | 18.9.2019 | 4.6.2020 | 260 days | 17.10.2019 | 26.5.2020 | 223 days, 0.16 °C |
| Leppäjoki | 13.10.2020 | 30.5.2021 | 230 days | 17.10.2020 | 11.5.2021 | 205 days, 0.21 °C |

# 4. Cumulative development of river temperatures from the suggested spawning times of pink salmon and Atlantic salmon to the end of following spring and to the middle of July

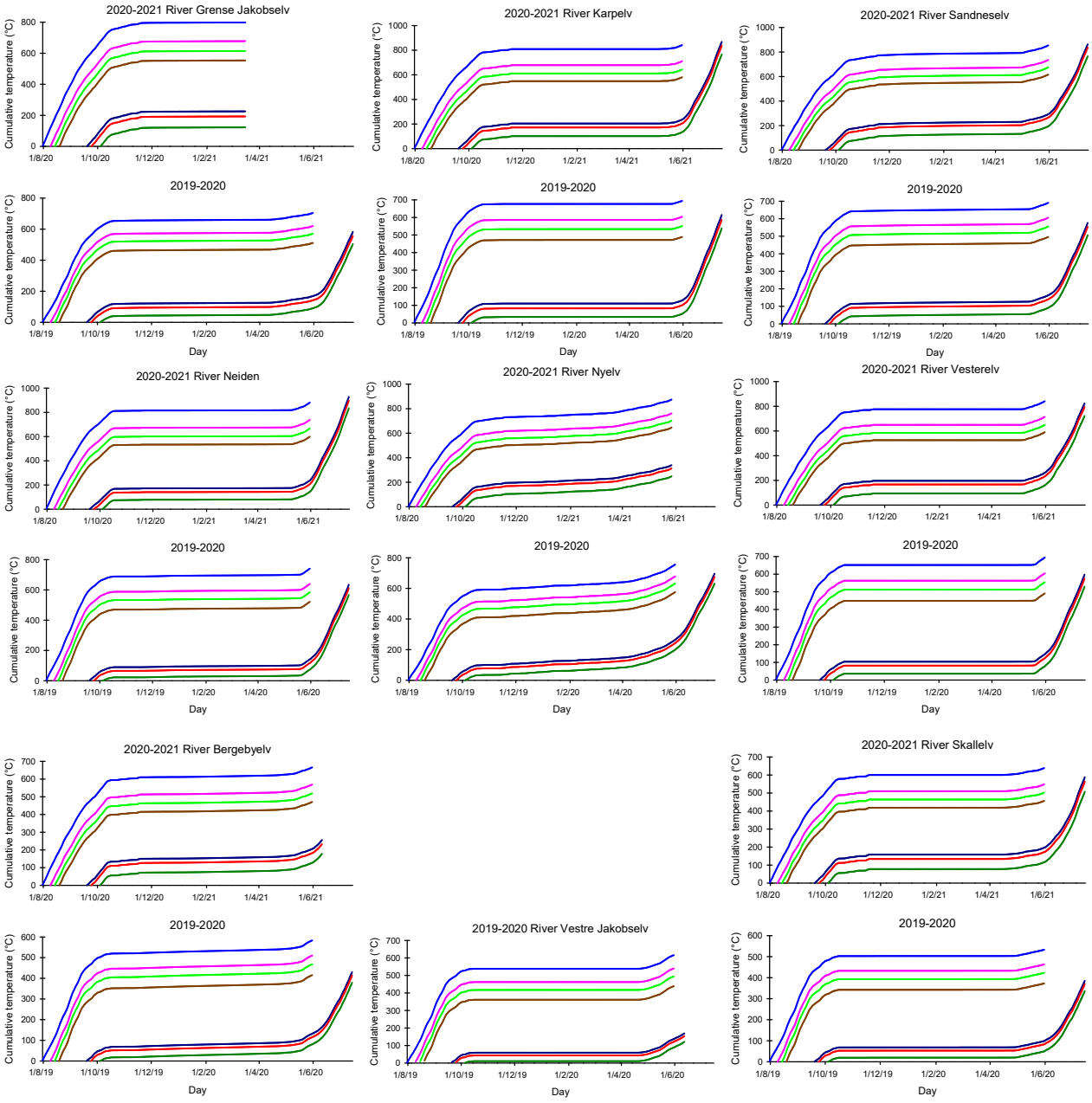


Figure 13. Cumulative temperatures from the suggested spawning times of pink salmon (1., 10., 15., 20. August) and of Atlantic salmon (20., and 25. September and 5. October) to 31. May and to 15. July in Finnmark rivers in the years 2019-2021. Source; County Governor (Norway)

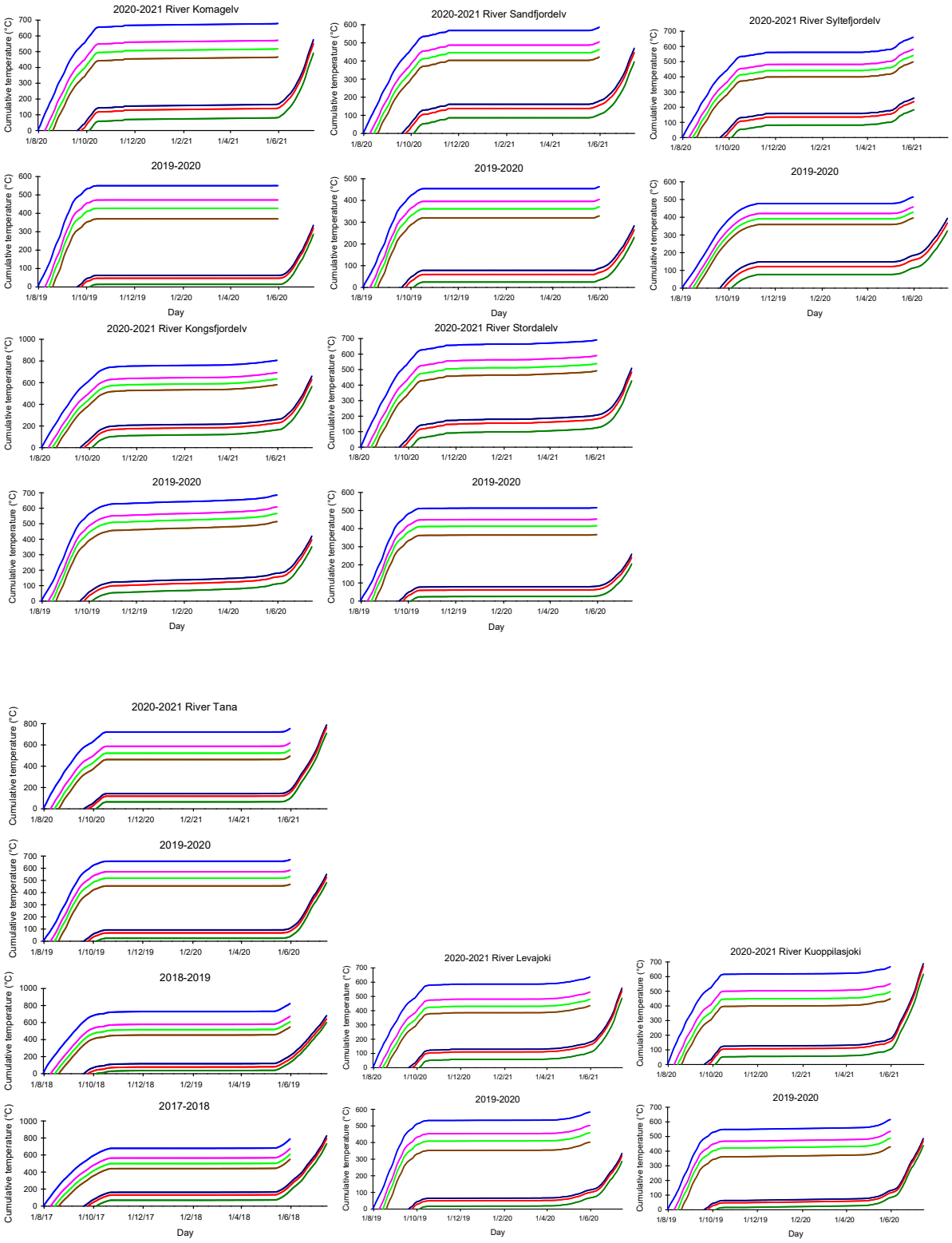


Figure 14. Cumulative temperatures from the suggested spawning times of pink salmon (1., 10., 15., 20. August) and of Atlantic salmon (20., and 25. September and 5. October) to 31. May and to 15. July in Finnmark rivers and in the River Tana watershed in the years 2017-2021. Source; County Governor (Norway), Luke (Finland).

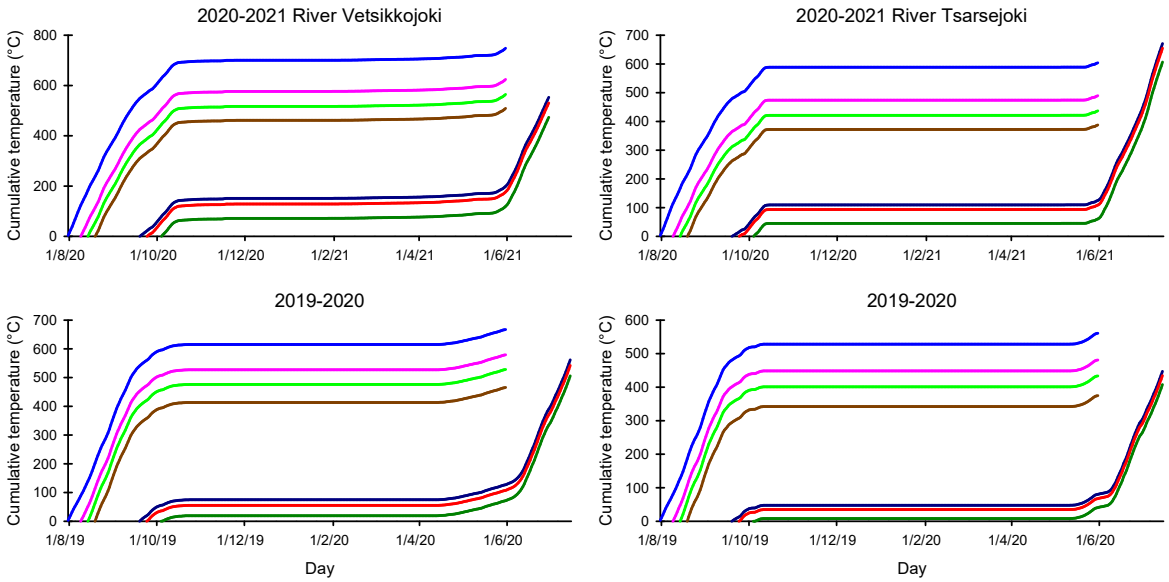


Figure 15. Cumulative temperatures from the suggested spawning times of pink salmon (1., 10., 15., 20. August) and of Atlantic salmon (20., and 25. September and 5. October) to 31. May and to 15. July in the River Tana watershed in the years 2019-2021. Source; Luke (Finland).