Kolarctic ENPI CBC - Kolarctic salmon project (KO197) - Report V

# Escaped salmon, its abundance and timing in the research fishery and in the reported salmon catches in Nordland, Troms and Finnmark in 2011 and 2012

Eero Niemelä[1], Esa Hassinen[1], Jari Haantie[1], Jorma Kuusela[1], Pauli Aro[1], Satu Metsola[1], Tiia Kalske[2] (red.)

*[1]Finnish Game and Fisheries Research Institute (FGFRI), Teno River Research Station Utsjoki, Finland*
*[2]Office of the County Governor of Finnmark (FMFI), Vadsø, Norway*

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For more information concerning this publication contact:

Fylkesmannen i Finnmark
Miljøvernavdelinga
Statens hus
9815 VADSØ

fmfipostmottak@fylkesmannen.no

*Cover page photos:*
*Photos 1-3. Photo 1 (on the left above) salmon cage production in Kvaenangen in Troms County, photo 2 (on the right above) cage production in Varangerfjord in Finnmark County, photo 3 (below) escaped salmon caught in Repvåg (outer Porsangerfjord)*

Photo 30: unknown origin
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*NINA Institute arranged the special permission from Norwegian Directorate of Nature Management for fishing outside the ordinary season.*

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## Abstract

The aim of this study was to clarify the abundance and occurrence of escaped salmon in salmon fishery within Kolarctic salmon project area at sea in Northern Norway during the period from the beginning of May to September. It is known that escaped salmon ascend into the rivers later than wild salmon and might therefore avoid being caught in rivers. Late ascending into the rivers is increasing the risk for genetic disorders for wild salmon, changes in the original genetic stocks if and when escaped salmon spawn with wild salmon. Material collected in Kolarctic salmon project in the years 2011 and 2012 illustrates precisely the timing of escaped salmon in the fishery by comparing timing with wild salmon, timing in different geographical areas, size of escaped salmon, salmon lice, how correctly fishermen are able to identify escaped salmon as real escaped salmon. One of the most important outcomes from the Kolarctic salmon project within "escaped salmon part" of the work was to analyze the role of escaped salmon in the official catches. Salmon cage culture production in Norway in Kolarctic salmon project area has exceeded in the year 2012 the level of 400 000 metric tons and some amount of salmon has succeeded in escaping from the cages during the process. Escaped salmon occurred in the catches through the research period from early May to the end of September in the whole Kolarctic salmon project area in Northern Norway. Escaped salmon contributed in the Kolarctic area into the catches c. 10% during that time when most of wild salmon are on their way to the rivers of origin between the weeks 22 and 28, from the late May to the middle of July. After that period the numbers of escaped salmon still increased for the following couple weeks. In August escaped salmon made in the catches up to 25-35% of all salmon caught. Results are indicating that escaped salmon are available to be caught during the entire wild salmon migration period close the shorelines in Northern Norway. In the middle of August they made in the year 2011 40-50% and in the year 2012 30-40% of salmon catches in terms of weight. Escaped salmon occurred most often in the catches in July and August. Of all escaped salmon caught in Kolarctic area in the years 2011 and 2012 between May and September their occurrence was highest in June with 41%. Median dates of catches were much later for escaped salmon than for 2SW, 3-4SW and previous spawners which confirm the fact that escaped salmon has later migratory pattern compared to wild salmon in general. It is a common local and traditional knowledge that females in all size groups as well as in all sea-age groups of wild salmon are in general migrating a little earlier than males. The difference in the timing of migrations was also true for female and male escaped salmon. In Nordland County cumulative percentages of wild and escaped salmon catches are close to each other indicating that escaped salmon are more mixed with the wild salmon populations during their migration period than in Troms and Finnmark areas. Females had clear majority in the catches of escaped salmon when migrations commenced along the coastal lines. Slowly the proportions of males increased and males reached the clear majority of c. 75% from escaped salmon in the last week of July and thereafter the proportions stayed more or less stabile. Mean lengths and weights of wild salmon were smaller than those of escaped salmon in all areas and that was true of both sexes. Mean lengths and weights of female escaped salmon were almost the same during the whole summer in Troms and Finnmark while exceeding those in Nordland. In males the mean lengths and weights, however, declined slowly towards the autumn. Salmon fishermen recognized 57% of the real escaped salmon in 2012 and researchers recognized the lacking 43% of the salmon scale structure. Fishermen very seldom identified wild salmon as escaped fish. In Nordland County escaped salmon occurred with extremely high percentages

in both years. Of the officially reported numbers of salmon as much as 44% was escaped salmon and almost half of the catch in terms of weight was escaped salmon. In Troms County 18-22% of the officially reported numbers of salmon were escaped salmon. In Finnmark County c. 10 fish out of 100 salmon caught were escaped fish in 2011 and their occurrence declined in 2012. The occurrence of escaped salmon over the entire summer in the catches in the outermost coastal areas as well as in the inner parts of the fjords makes it difficult to tailor specific fishing rules to allow effective fishery only towards escaped salmon. The highest number of salmon lice in escaped and wild salmon was 99 and 89, respectively. Salmon with the highest numbers of lice were caught mainly in Troms County. One interesting phenomenon was a previous spawning female salmon with the sea-age of 3S1+ years carrying 74 lice. This indicates that this female fish visited freshwater, stayed there almost one year, and thereafter descended back to seawater. During the post spawning period of almost one year at sea, over 70 lice attached to it. In salmon belonging into salmon stocks which have their rivers of origin in seven Regional Group areas, the mean numbers of lice are increasing from May-June towards autumn. In all maiden salmon sea-age groups and slightly also in previous spawners the mean numbers of lice are increasing towards west, where the salmon cage culture is much more intensive than in Finnmark. It's known that in the coastal areas there are many stocks mixed together during summer when they are migrating towards their home river and still there are differences between counties in the infestation rate. More accurate data was available in Kolarctic salmon project where it was possible to study and compare spatial and temporal stock specific infestation rates. Although the numbers of lice per kilo salmon varied clearly for 1SW and 2SW salmon stocks between the neighboring rivers the numbers of lice were higher in those salmon stocks which located further west compared to the stocks in Finnmark. The levels of infestation are clearly highest in Nordland for wild salmon throughout the summer months and rates are declining towards east, towards Finnmark County. Early in May a quarter from wild 1-4SW female salmon was immature but in wild males the proportion of immature fish was c. 50% almost the entire May. In escaped male salmon the proportion of immature fish was like in wild salmon until the middle of June and thereafter the proportion was higher than in wild males. In escaped females the proportions of immature fish was higher than in wild female salmon until the second half of June and after that period escaped salmon was as mature as wild salmon. This indicates that all wild salmon as well as escaped salmon were mature in females and males in the end of summer.

# 1. Introduction

In the Kolarctic ENPI EU salmon project one of the main goals is to study the migration patterns of wild and escaped salmon along the outermost coastal areas as well as in the fjords. Traditional knowledge from the old salmon fishermen tells that there is some salmon migration early in the spring. Some fishermen have told that there has been also escaped salmon available to be caught in May. Therefore fishermen had special permission to initiate the fishery early in May and continue salmon fishing to September allowing the fishery before and after the official fishing season.

Salmon cage culture has increased during the last 30 years not only in Nordland and Troms but also in Finnmark and the production will most probably increase in the near future with both increased number of farming sites and production volumes. In North-West Russia salmon cage culture production has also increased in recent years. Reported salmon catches during the official fishing time in summer are including both wild and escaped salmon together and the official catch reporting scheme does not give a possibility to separate wild and escaped salmon. Outside the official salmon fishing season it is allowed in some areas, except in Finnmark, to catch salmon with a special purpose to target the fishery to escaped salmon and in that fishery wild and escaped salmon are reported separately.

Salmon cage culture production has increased in Norway and it has reached the amount of more than 1200 000 metric tons in the year 2012 (Figure 1). In early 1990's c. 75% of the total salmon cage culture production took place in the areas outside Nordland, Troms and Finnmark counties, but since the year 2010 37% of the production took place there. In the three northernmost counties the production has increased faster than in other areas in Norway. The production of salmon in Finnmark makes today c. 7% and in Troms c. 12% of the entire annual production in Norway.

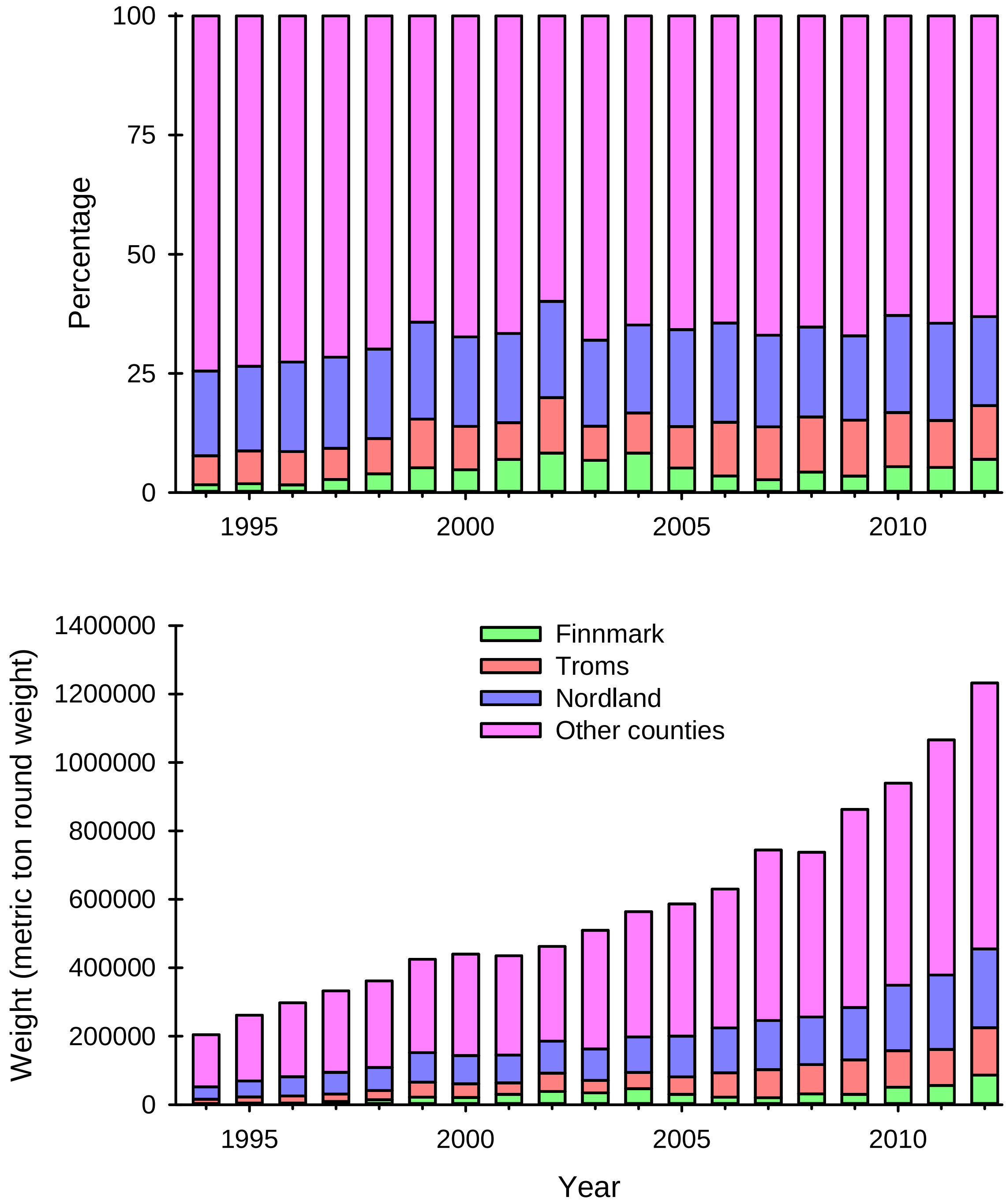



*Figure 1. Development in salmon cage culture production at sea in Norway with special emphasize on the production in the three northernmost counties (Source: http://www.fiskeridir.no/fiskeridirektoratets-statistikkbank)*

## 2. Material and methods

In the years 2011 and 2012 58 fishermen in all were contributing to the Kolarctic salmon project by delivering samples from their salmon catches. Fishermen were distributed along the coastal areas between North Nordland and East Finnmark and their fishing sites were in the outermost coastal areas as well as in the fjords (Figure 2). The locations of active and passive salmon and trout cage culture sites are presented in the figure 3.

Fishermen measured lengths and weights from all the salmon they caught. They also took scale samples for age determination and to separate escaped fish from wild salmon. Scales of salmon are used to identify escaped salmon from wild salmon using differences in the growth patterns during the freshwater and saltwater growth phases. The date of the capture, sex, fishing method (bag net or bend net), whether it was a wild or an escaped salmon and the number of salmon lice were recorded on the scale envelope. The numbers of salmon lice in this research are based on the counting done by fishermen and those values are the minimum numbers of the adult parasites. Some amount of salmon lice fell off of the fish when fishermen removed salmon from their nets. All fishermen were informed with a special brochure how to make difference between wild and escaped salmon. Directorate for Nature Management (DN) gave a special permission to fishermen to catch salmon before and after the official fishing season from early May to September. Sampling, scale collection and scale processing are described in Kolarctic ENPI CBC - Kolarctic salmon project (KO197) - Report I (Niemelä *et al* 2014) and in the special scale sampling protocol produced in this Kolarctic salmon project.

Smolt ages, sea-ages, possible previous spawning and the growth of a salmon throughout its life history can be determined from scale images, thus the origin of a salmon (whether wild or escaped) can be identified from them. In most of multi-sea-winter salmon (2SW (two-sea-winter) and older salmon) scales the growth during the second year at sea has not been normal in recent years compared to the growth in scales in previous years. This might indicate changes in the amount of food available for salmon or changes in sea water temperatures. This unusual growth weakening has resulted in the formation of slow growth period in the scales during the second summer and therefore in the scale analysis researcher must be careful not to mistake a wild salmon for an escaped salmon.

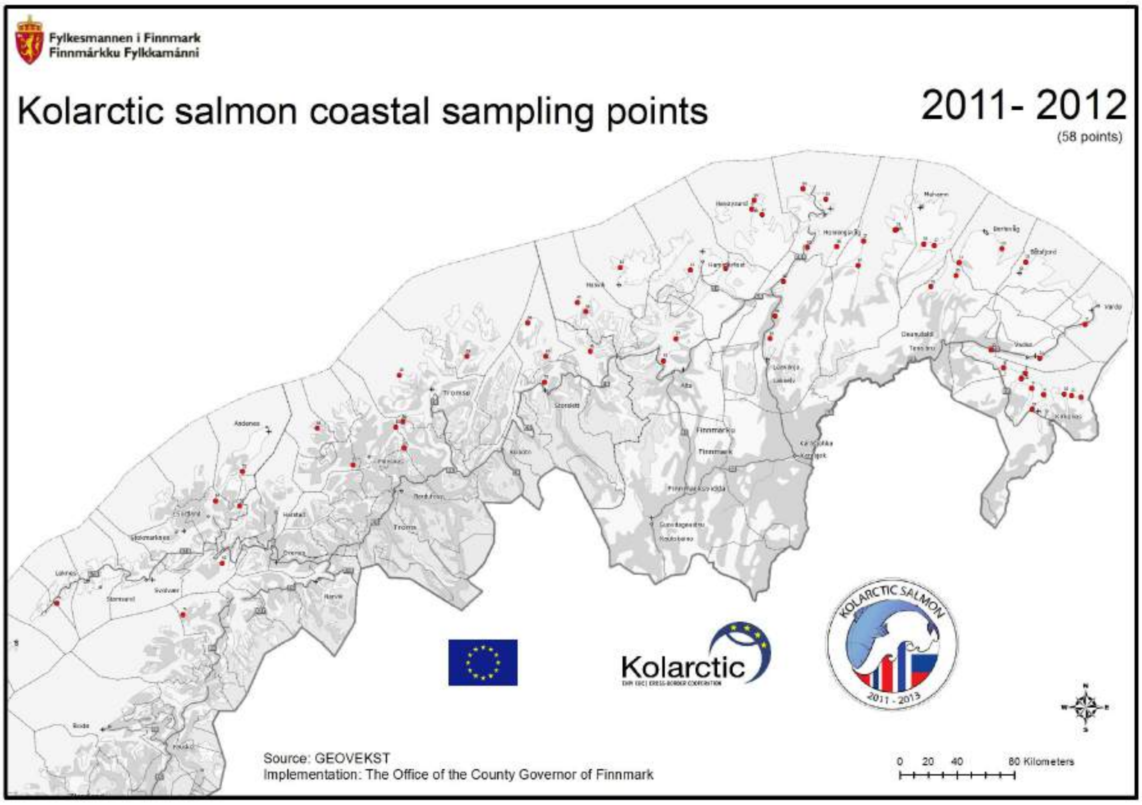



*Figure 2. Sites (red points) of the salmon research fishing at sea in the years 2011 and 2012.*

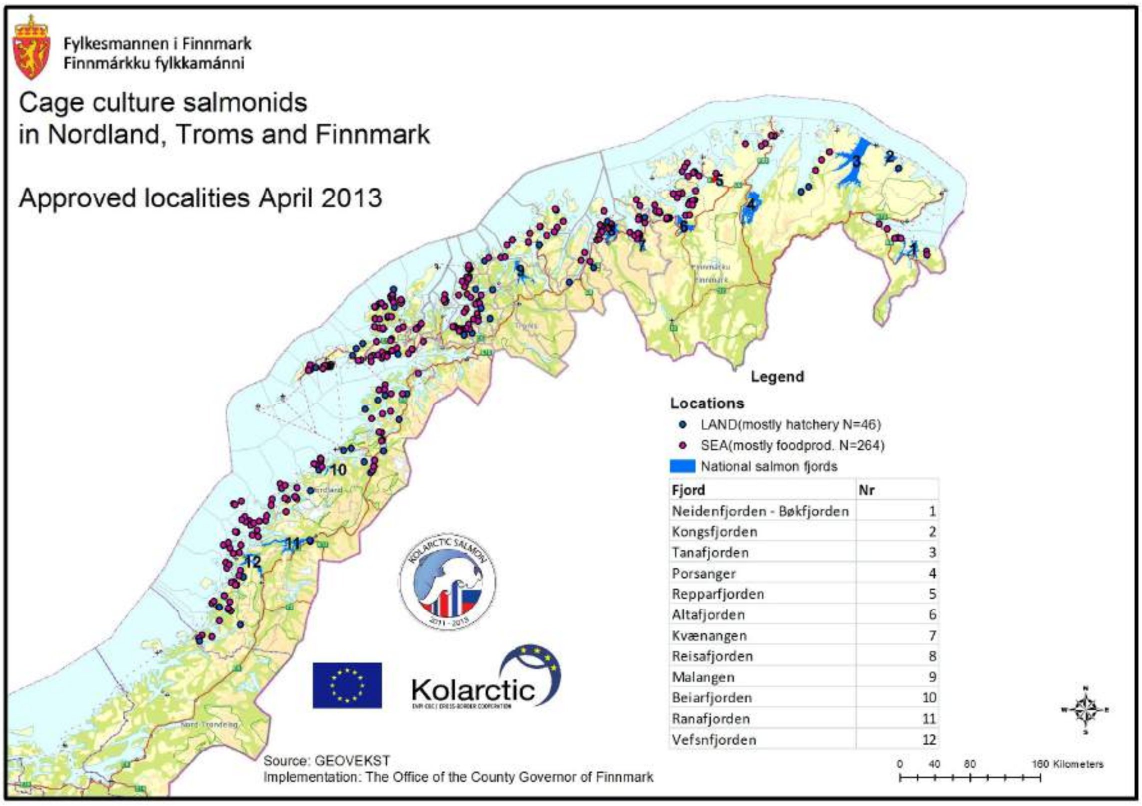



*Figure 3. Sites (red points) for salmon (mainly Atlantic salmon) cage production in Nordland, Troms and Finnmark Counties in the spring 2013. All sites were not in active use in the spring 2013.*

*Photo 4. Scale from an escaped salmon and scale from wild 3SW salmon (see photo 5 on next page). Based on scale analysis it is possible to separate escaped salmon and wild salmon from each other. Especially the growth information in the freshwater growth phase clearly indicates the origin of salmon.*


*Photo 5. Scale from a wild 3SW salmon. Based on scale analysis it is possible to separate escaped salmon and wild salmon from each other. Especially the growth information in the freshwater phase clearly indicates the origin of salmon.*

*Photo 6. Josef Samuelsen, Repvåg Porsangerfjord is taking salmon off, of his bend net.  He caught a nice looking, silvery, median size, male salmon, but unfortunately it was an escaped salmon. Josef recognized immediately his fish as an escaped salmon.*

*Photo 7. Laurits Johansen at his bend net fishing site in Skjånes, Hopsfjord (in outer Tanafjord). In the boat there are two salmon, one wild and one escaped fish. Salmon cage culture was prohibited in Tanafjord in early 2000s'. Tanafjord is one of the national salmon fjords in Norway.*

*Photos 8 and 9. A wild male salmon pictured on the left (photo 8) and an escaped male salmon on the right (photo 9). Escaped salmon have many black spots on the gill covers compared to only 2-4 spots on wild salmon. The high number of spots can be found also in previous spawning salmon and therefore it is important for fishermen to look also for the other morphological characters. Fishermen do not separate escaped salmon from wild salmon in the catches during the normal fishing season and therefore in the daily catch reports the numbers of wild salmon are higher than they should be at least in some areas.*

*Photos 10 and 11. A Wild salmon pictured on the left and an escaped salmon on the right. Fishermen were advised to carefully identify the origin of salmon (wild or escaped). Based on long-term experimental observing some fishermen told that there is one very clear difference between wild and escaped salmon. For instance in escaped salmon there is extra tissue between the intestine and the wall of the body cavity. This extra tissue is binding the intestine especially in the back side of the cavity. This phenomenon is caused by the vaccinations and might disappear when escaped salmon grow.*

*Photo 12. Cage culture of salmon is increasing in Varangerfjord as well as on Russian side in Northwest Kola Peninsula.*

# 3. Results

## *3.1 Escaped salmon is occurring from spring to late autumn in the coastal waters*

Salmon which were kept at sea for cage culture purposes and which have escaped from the net pens were occurring in the catches through the research period from early May to the end of September in the Kolarctic salmon project area (Figure 4). Early in May escaped salmon made as much as 25% of the catches at that time of the summer when wild salmon have not started the migrations along the coastal areas. The proportions of escaped salmon naturally declined in the salmon catches after wild salmon migrated into the coastal and fjord areas although also the numbers of escaped salmon in the catches increased (Figures 4, 6). Escaped salmon made in the Kolarctic salmon project area in the catches c. 10% during that time when most of wild salmon are on their way to the rivers of origin between the weeks 22 and 28, from the late May to the middle of July. After that period the numbers of escaped salmon still increased during a couple weeks time. In August escaped salmon made in the catches up to 25-35% of all salmon caught. After the official fishing season from the beginning of the second week in August the effort of salmon fishermen in the research to catch salmon dramatically declined which weakens the results in August. Anyhow, the results are indicating that escaped salmon are available to be caught during the entire wild salmon migration period close the shorelines in Northern Norway and they made in the year 2011 40-50% and in the year 2012 30-40% of salmon catches in terms of weight in the middle of August (Table I). Escaped salmon occurred most often in the catches in July and August. Of all escaped salmon caught in Kolarctic salmon project area in the years 2011 and 2012 between May and September their occurrence was highest in June with 41%.

Table I. Monthly numbers of escaped salmon in Kolarctic salmon project research fishery in Northern Norway in the years 2011 and 2012. The percentage distributions of escaped salmon between the months for each county are in parenthesis. In the row of total numbers in parenthesis there are the percentage distributions between months for all the counties combined.

| County/Year | May | June | July | August | September | October | Total, total- % |
|---|---|---|---|---|---|---|---|
| **Nordland/2011** | | 14, (19) | 44, (60) | 15, (21) | 2 | | 75, (7) |
| **Troms/2011** | 15, (4) | 65, (18) | 179, (49) | 102, (28) | 5, (1) | | 366, (36) |
| **Finnmark/2011** | 61, (10) | 136, (23) | 267, (46) | 118, (20) | 3, (1) | | 585, (57) |
| **Total/2011** | **76, (7)** | **215, (21)** | **490, (48)** | **235, (23)** | **8, (1)** | | **1026** |
| **Nordland/2012** | 14, (9) | 53, (35) | 31, (20) | 54, (36) | | | 152, (14) |
| **Troms/2012** | 8, (2) | 82, (21) | 175, (44) | 128, (31) | 2, (1) | 3, (1) | 398, (35) |
| **Finnmark/2012** | 27, (5) | 131, (23) | 189, (34) | 215, (38) | 2, (<1) | | 564, (51) |
| **Total/2012** | **49, (4)** | **266, (24)** | **395, (35)** | **397, (36)** | **4,** (<1) | **3,** (<1) | **1114** |
| **Total/2011,2012** | **125, (6)** | **481, (22)** | **885, (41)** | **632, (30)** | **12, (1)** | **3,** (<1) | **2140** |

*Photo 13. Svein Sørensen, Veidnes, Laksefjord on his way back from his bend net fishing site. Salmon cage culture has increased production also in Laksefjord and escaped salmon often occur in the catches there.*

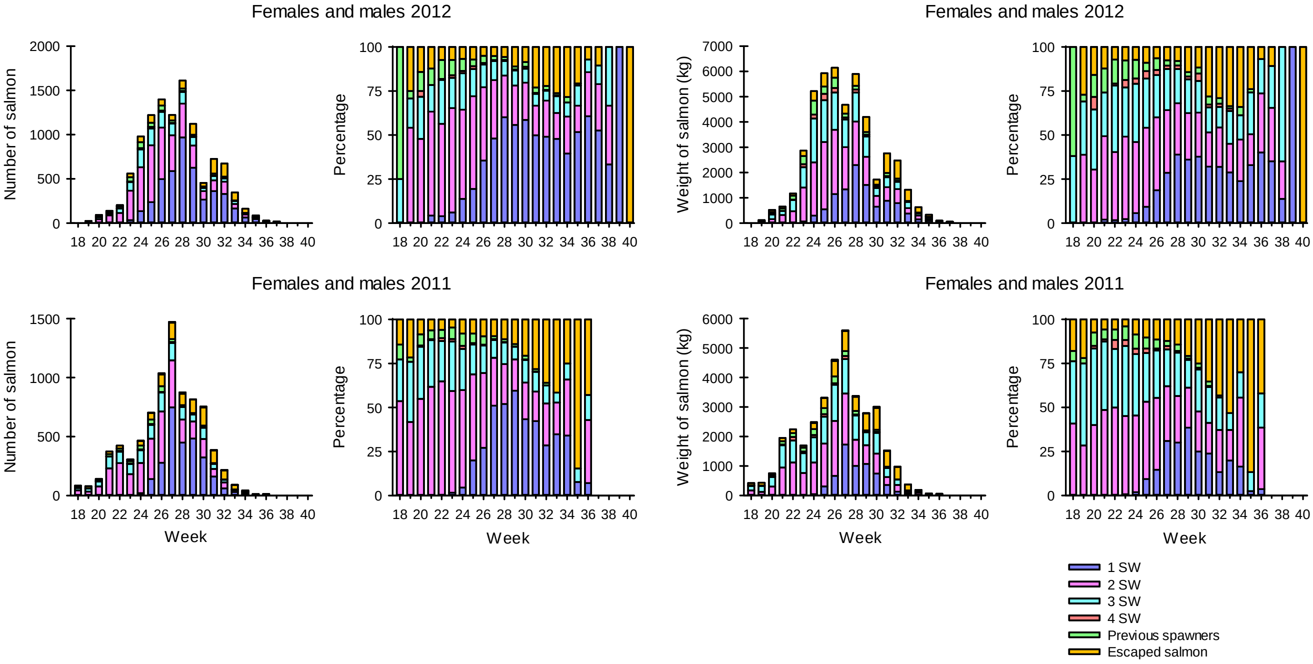



*Figure 4. Weekly numbers (on the left) and weights (on the right) and corresponding percentages of escaped salmon (orange color in the figures) and 1-4SW (SW, sea-winter) salmon and previous spawner wild Atlantic salmon catches in Kolarctic area in the years 2011 and 2012.*

Cumulative percentages in the salmon catch development through the summer indicate that escaped salmon were caught already early in May. Their catches cumulated very slowly compared to the catch developments of wild salmon in all sea-age groups in maiden fish and previous spawners (Figure 5). Median dates of catches were almost the same for wild 1SW salmon and escaped salmon in both of the research years. Interestingly, median dates of catches were much later for escaped salmon than for 2SW, 3-4SW and previous spawners which confirm the fact that escaped salmon have a later migratory pattern compared to wild salmon in general.

*Photo 14. Leif Ingilæ Bugøynes, Varangerfjord*

*Photos 15-18. The skin of the fish must first be washed to remove any extra mucus from other fish (photo 14 on the left above), scales are then taken with a clean knife just from the area between adipose fin and lateral line (photo 15 on the right above and photo 16 on the left below) and finally scales are put into a scale envelope (photo 17 on the right below). The number of scales in each scale bag was around 20-30.*

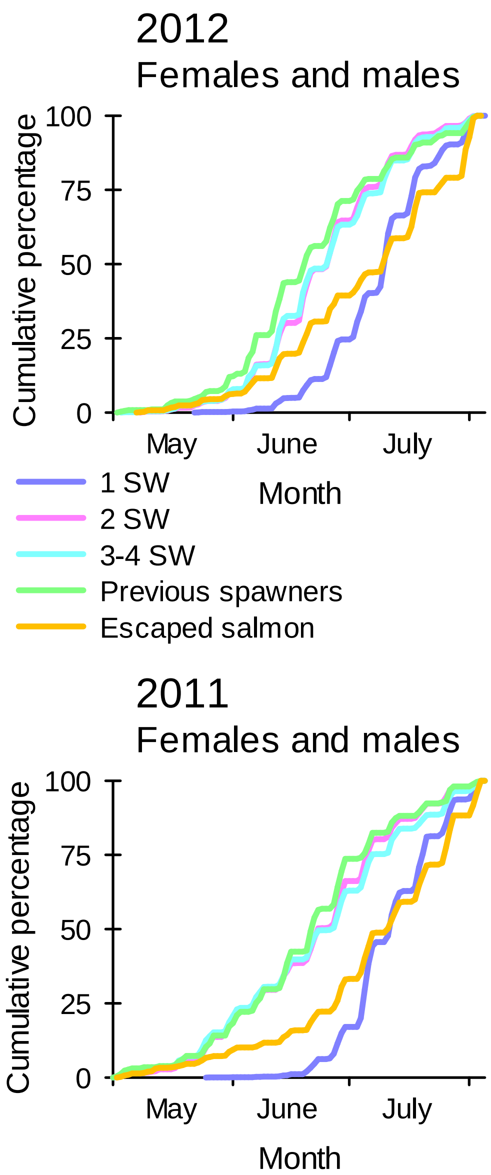



*Figure 5. Cumulative percentages of wild and escaped salmon catches in Kolarctic –project area in Northern Norway in the years 2011 and 2012. Samples are from the beginning of May to August 4. Data is the same as in the figure 4.*

Figure 5 indicates more or less steady increase in the numbers of escaped salmon in the coastal catches in both sexes. All fishermen were very active to catch salmon early in the research period and after three months weekly fishing activities their interest got weaker which can also be seen in the sharp declining of the numbers of escaped salmon in the middle of August. Escaped salmon catches peaked on the week 30 in the year 2011 and one week later in 2012 (Figure 6). Sharp declining in the catches in the week 30 in 2012 resulted from the low abundance of wild salmon and escaped salmon during that week in the whole Kolarctic area.

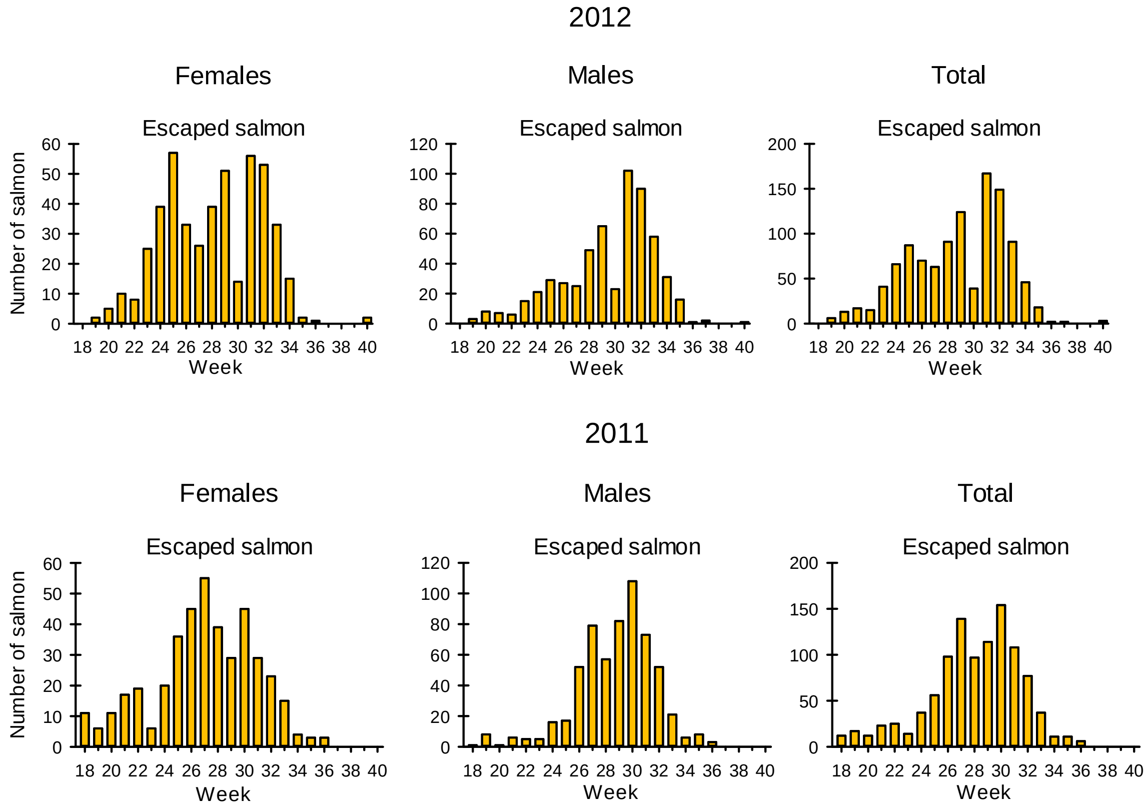



*Figure 6. Weekly numbers of female and male escaped salmon in Kolarctic project area in Northern Norway in the years 2011 and 2012.*

*Photo 19. Laurits Johansen identified this fish as an escaped salmon.*

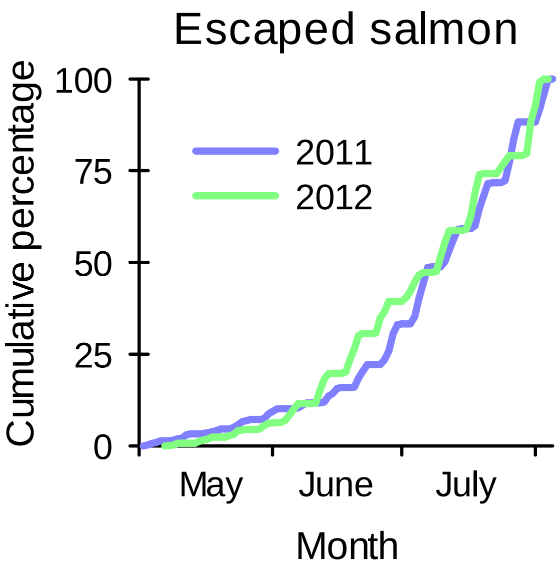



*Figure 7. Differences in the annual cumulative percentages of the escaped salmon catches in Kolarctic salmon project area in Northern Norway in the years 2011 and 2012. Samples are from the beginning of May to August 4.*

Escaped salmon had surprisingly equal migratory patterns in both of the research years (Figure 7). Only the lower quartile of the cumulative catches took place earlier in 2012 compared to year 2011. The same kind of patterns in the timing of the migrations are explained by the similar sea temperatures, wind directions etc. which were governing during migration activities in 2011 and 2012 and also the daily fishing activities must have been the same in both years.

*Photo 20. Gunnar Olsen fish in Kjøllefjord (Laksefjord).*

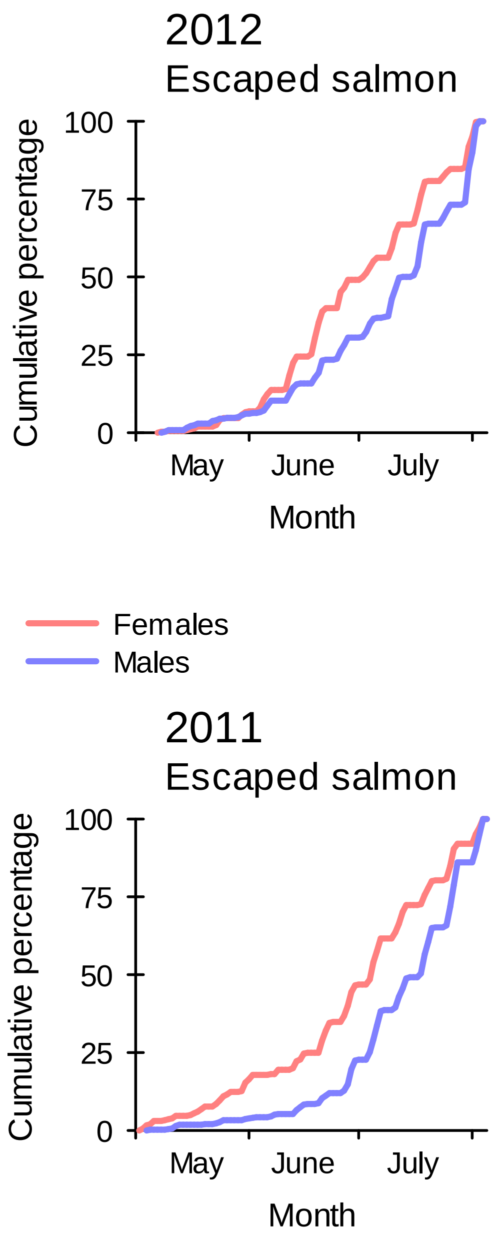



*Figure 8. Cumulative percentages for female and male escaped salmon catches in Kolarctic salmon project area in Northern Norway in the years 2011 and 2012. Samples are from the beginning of May to August 4.*

It is a common local and traditional knowledge that females in all size groups as well as in all sea-age groups of wild salmon are in general migrating a little before males. This difference in the timing of migrations was true also for female and male escaped salmon (Figure 8). This inherited feature has remained in the cage cultured salmon although its genomes has been mixed over many salmon generations and although the cage cultured salmon is a genetic mixture of many salmon stocks.

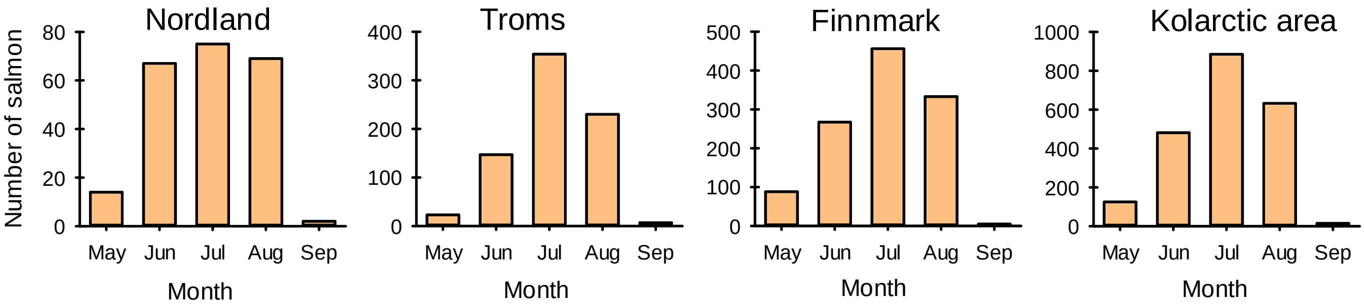
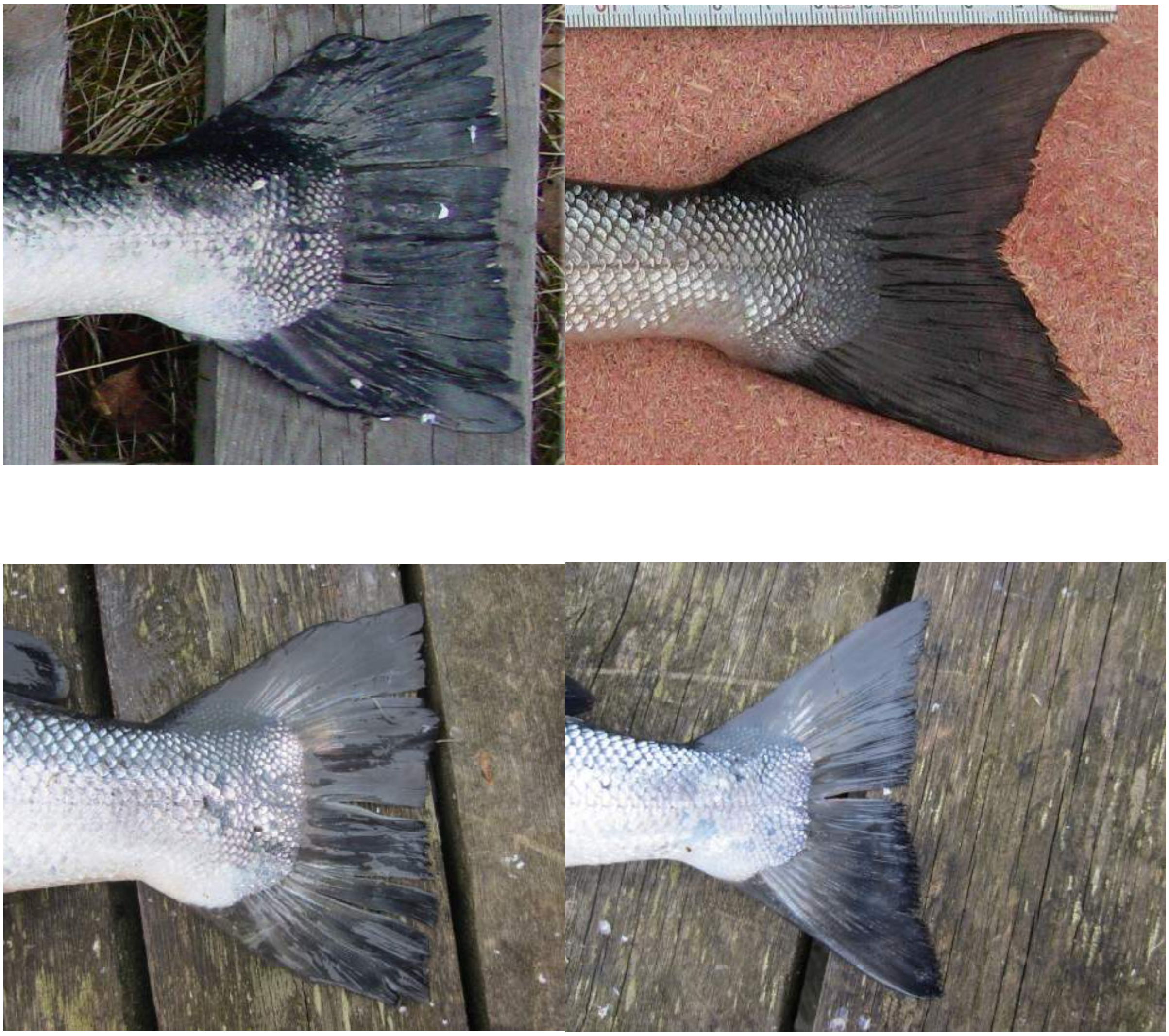



*Figure 9. Monthly numbers of escaped salmon in the salmon research fishery in 2011 and 2012.*

A crude migration pattern of escaped salmon can be observed if there are monthly differences in their abundance within and between counties. Figure 9 illustrates that at least in Troms and Finnmark areas escaped salmon is occurring in the catches similarly. Catches peaked there in July and before that catches increased similarly from May to June and then in July. In Nordland the catches were almost the same over three summer months. The abundance of escaped salmon in the catches during the summer increased much like the abundance of 1SW salmon. It is possible that the high numbers of 1SW salmon which are migrating towards their rivers of origin are affecting the migration of escaped salmon from their ocean feeding areas to coastal areas. It is known that social behavior can keep salmon stocks together during their ocean feeding period and therefore escaped salmon could follow those salmon like 1SW fish which are the most numerous sea-age groups in the spawning migration.

*Photo 21. Tore Eliassen, Porsangerfjord*



*Photos 22, 23, 24 and 25. Tail of escaped salmon is rounded and usually it has some damages in the fin rays (figures 18 and 20 on the left), but in wild salmon the ends of the tail are sharp (figures 19 and 21on the right).*

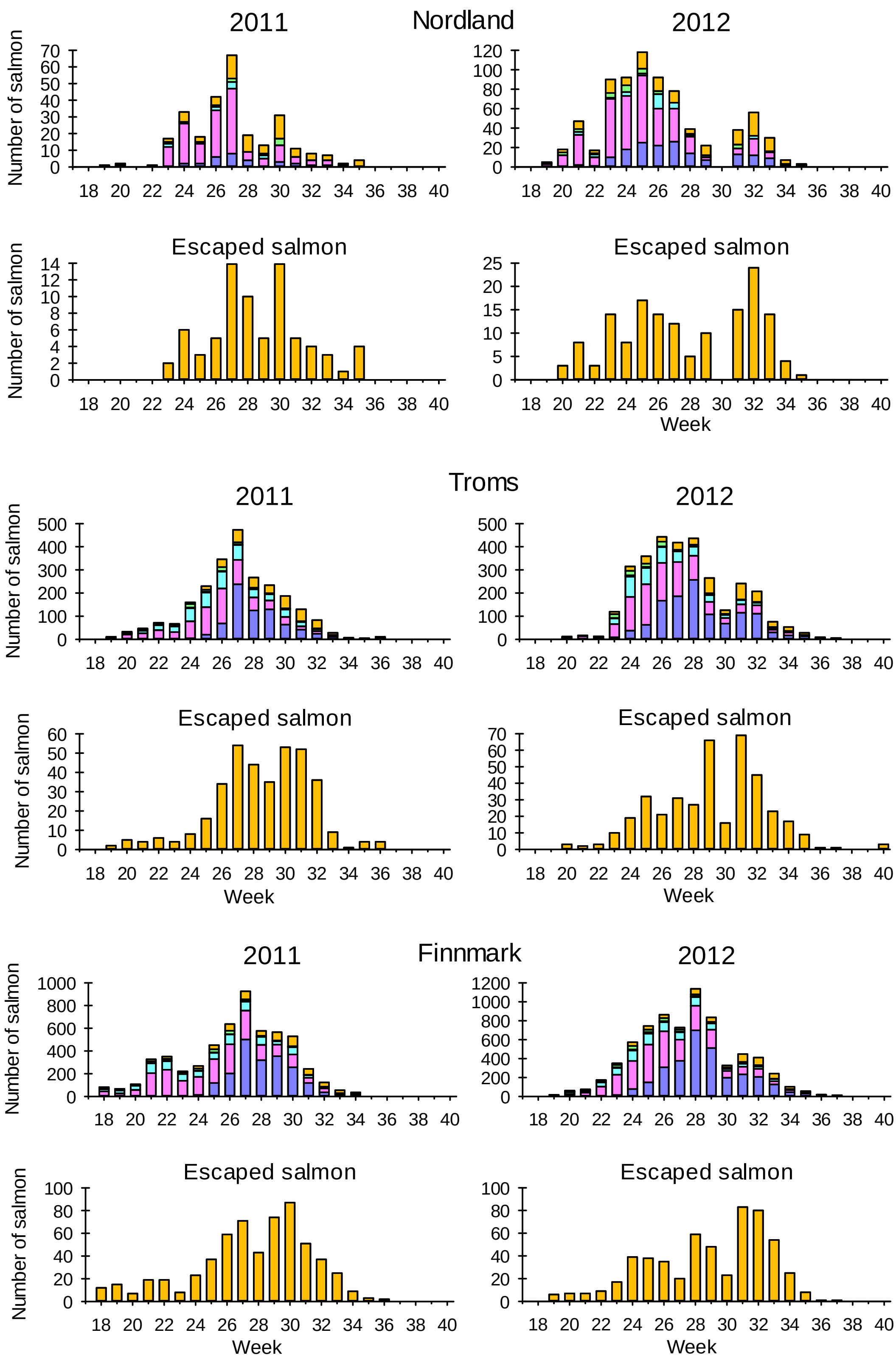



*Figure 10. Weekly abundance of escaped salmon (orange bars) in the catches throughout the summer from early May to September in three northernmost counties in Norway in the years 2011 and 2012. Other sea-ages are 1SW (dark blue bar), 2SW (red bar), 3-4SW (light blue bar) and previous spawners (green bar).*

*Photo 26. Kjell Ove Jensen cleaning the Alta- type bag net in Gjesvær, Nordkapp. In Gjesvær Kjell is one of the few remaining salmon fishermen. It takes more than half hour for him to drive to the salmon fishing site from home harbour.*

A more precise timing of escaped salmon in the fishery can be seen in figure 10 separately in the three counties. In Troms and Finnmark the weekly catches developed similarly during the summer. In the year 2012 the abundance of escaped salmon like also the abundance of wild salmon declined suddenly and simultaneously in the last week of July in all the counties. The occurrence of escaped salmon over the entire summer in the catches in the outermost coastal areas as well as in the inner parts of the fjords makes it difficult to tailor specific fishing rules to allow effective fishery only towards escaped salmon. The fishing effort was not the same in May and August-September compared to the effort during the peak migration time of wild salmon in June and July which had some effect on the numbers of escaped and wild salmon caught.

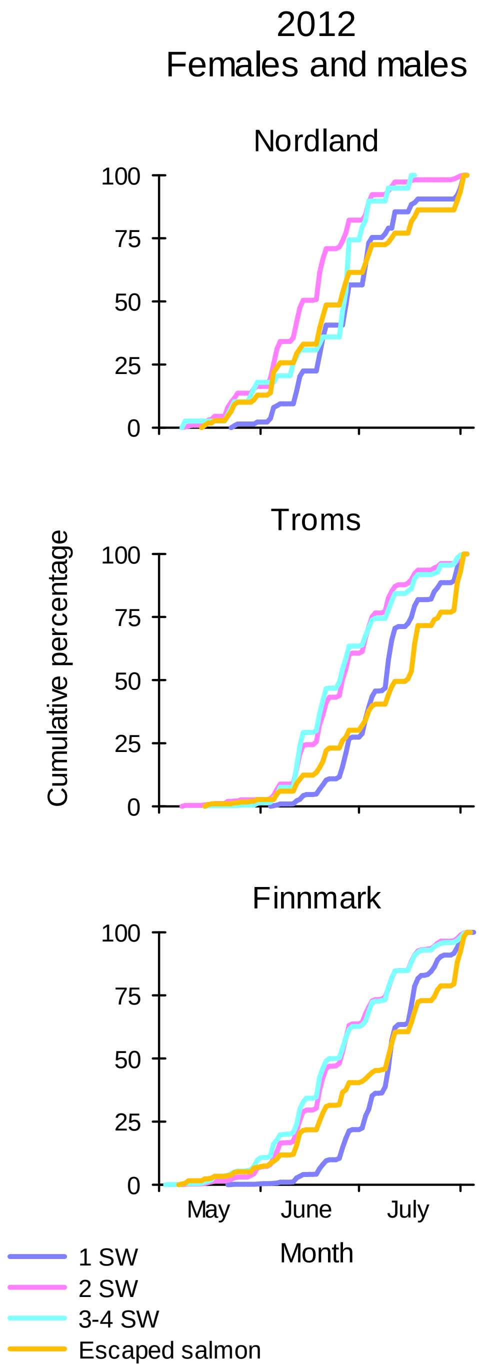



*Figure 11. Cumulative percentages of escaped and wild Atlantic salmon catches in Kolarctic salmon project area in three northern counties in Northern Norway in the year 2012. Samples are from the beginning of May to August 4.*

In Nordland County cumulative percentages of wild and escaped salmon catches are close to each other indicating that escaped salmon are more mixed into the wild salmon populations during their migration period than in Troms and Finnmark areas (Figure 11). In Troms and Finnmark areas escaped salmon are migrating clearly later than wild 2SW and 3-4SW salmon although early in the summer all these groups are simultaneously caught.

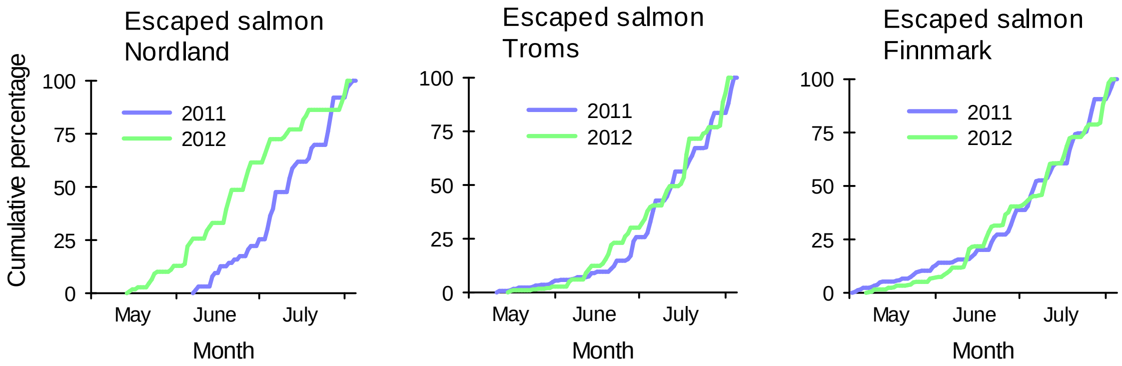



*Figure 12. Annual differences in the cumulative percentages of escaped salmon catches in Kolarctic salmon project area in Northern Norway in the years 2011 and 2012. Samples are from the beginning of May to August 4.*

Escaped salmon had surprisingly equal migratory patterns in both of the research years in Troms and Finnmark (Figure 12). Differences in the cumulative catches between the years in Nordland are caused by the later start of the research fishery in 2011 compared to the year 2012 and also some new fishermen fishing in other places were included in the year 2012 and that might have affected the changes in the timing in the catches of escaped salmon.

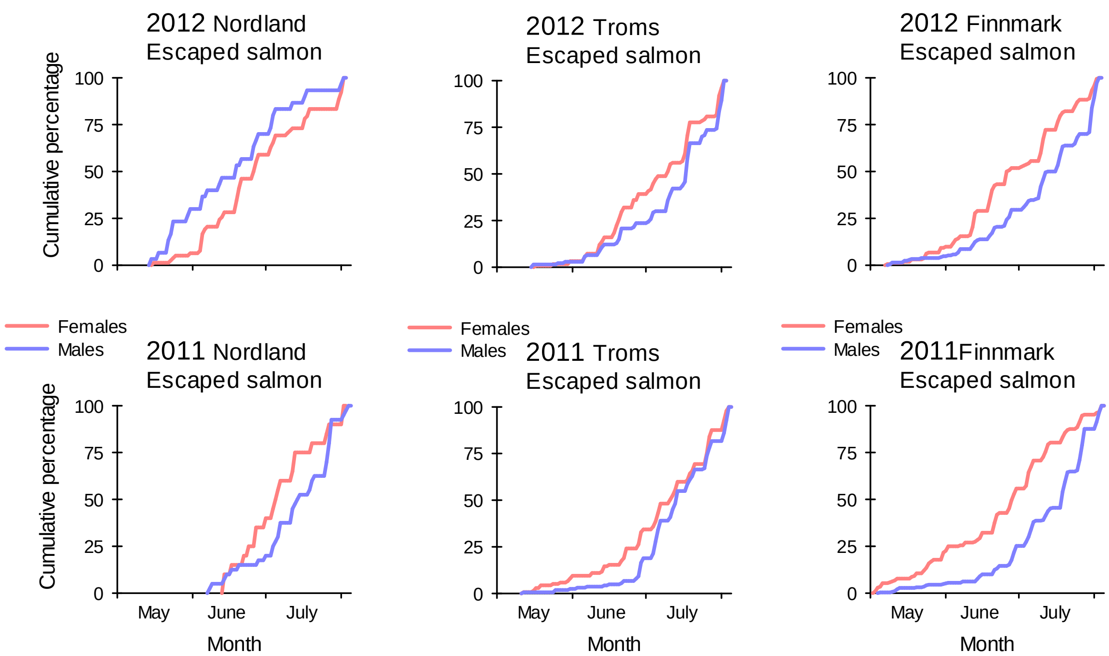



*Figure 13. Differences in cumulative percentages for female and male escaped salmon catches in three counties in Northern Norway in the years 2011 and 2012. Samples are from the beginning of May to August 4.*

*Photo 27. The outermost salmon fishing sites are exposed to northern and eastern winds making the fishery sometimes impossible. These fishermen fishing close to North Cape (Nordkapp) caught silvery two-sea- winter male salmon.*

The migratory patterns were almost the same in 2011 and 2012 for both female and male escaped salmon in Finnmark and Troms. Females ascended first to the coastal areas in Northernmost Norway (Figure 13). Differences in the timing between females and males in Nordland might reflect the different fishing activities early in the season and more fishermen delivering material in 2012 than in 2011. Female escaped salmon are migrating along the coastal areas quite close the migration periods of 2SW and 3-4SW salmon making it difficult to develop special tailored management measures which could focus only on escaped salmon in summer.

*Photo 28. An escaped rainbow trout (below) and a wild salmon which has partly been eaten probably by otter or some seabird in bend net.*

*Photo 29. An escaped salmon with a strongly eroded pectoral fin.*

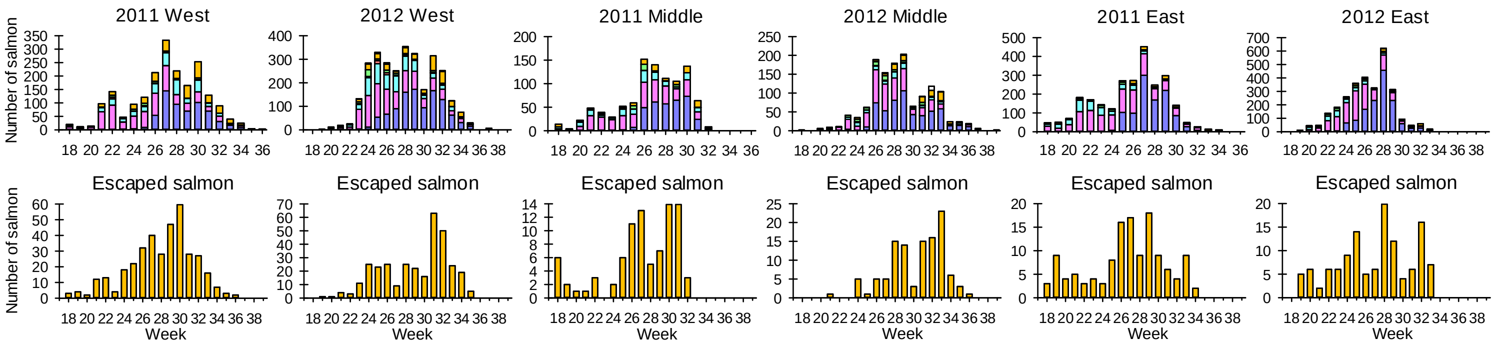



*Figure 14. Weekly numbers of escaped salmon in West, Middle and East Finnmark in the years 2011 and 2012. In the upper figure escaped salmon are indicated with orange color in the bars. Other sea-ages are 1SW (dark blue bar), 2SW (red bar), 3-4SW (light blue bar) and previous spawners (green bar).*

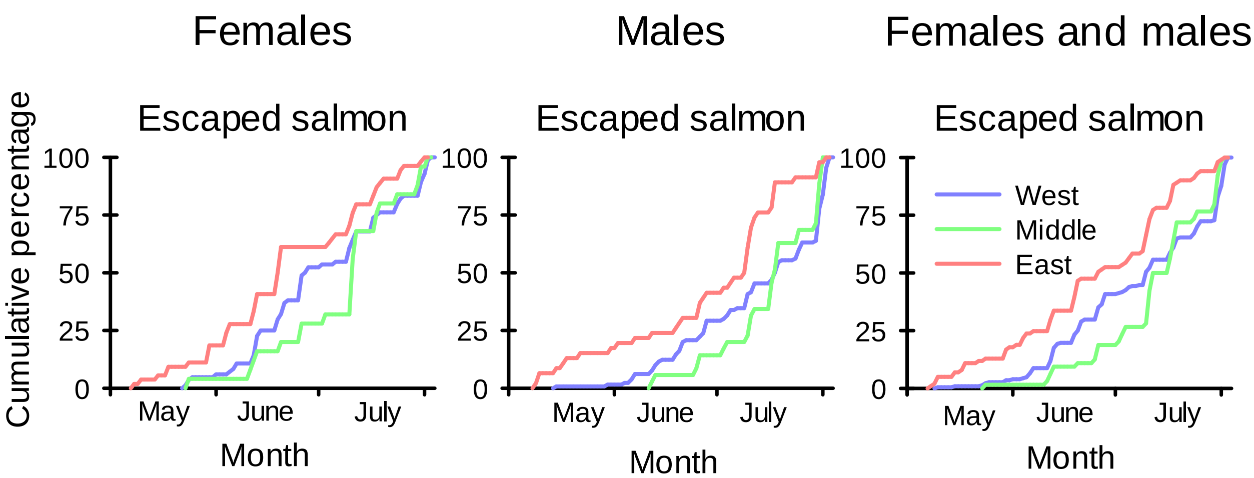



*Figure 15. Differences in the cumulative percentages for female and male escaped salmon catches in three geographical areas in Finnmark County (West, Middle, East Finnmark) in Northern Norway in the year 2012. Samples are from the beginning of May to August 4.*

There were clear annual differences in the timing of escaped salmon within and between three areas in Finnmark (West, Middle and East Finnmark). However the highest abundances of escaped salmon were reported close to the week 30 in all the areas (Figure 14). Declining abundance of escaped salmon in the catch after the end of the official fishing season on August 4th was reflected by the decreased effort in the fishery. Female and male escaped salmon accumulated into the catches first in East Finnmark followed by the accumulated catches in West Finnmark. Half of the escaped salmon catches accumulated later in Middle Finnmark than the catches in West and East Finnmark (Figure 15). At the end of the official fishing season the timing of escaped salmon catches in Middle Finnmark coincided with the catch timing in West Finnmark. The difference in the timing early in the season might reflect that sampling in Middle Finnmark mainly took place in the inner part of the fjords Tana and Laksefjord, but sampling in West and East Finnmark took place mainly in the outermost coastal areas where escaped salmon migrated before entering into fjords. Figure 15 also indicates that escaped salmon might migrate in Finnmark from east to west.

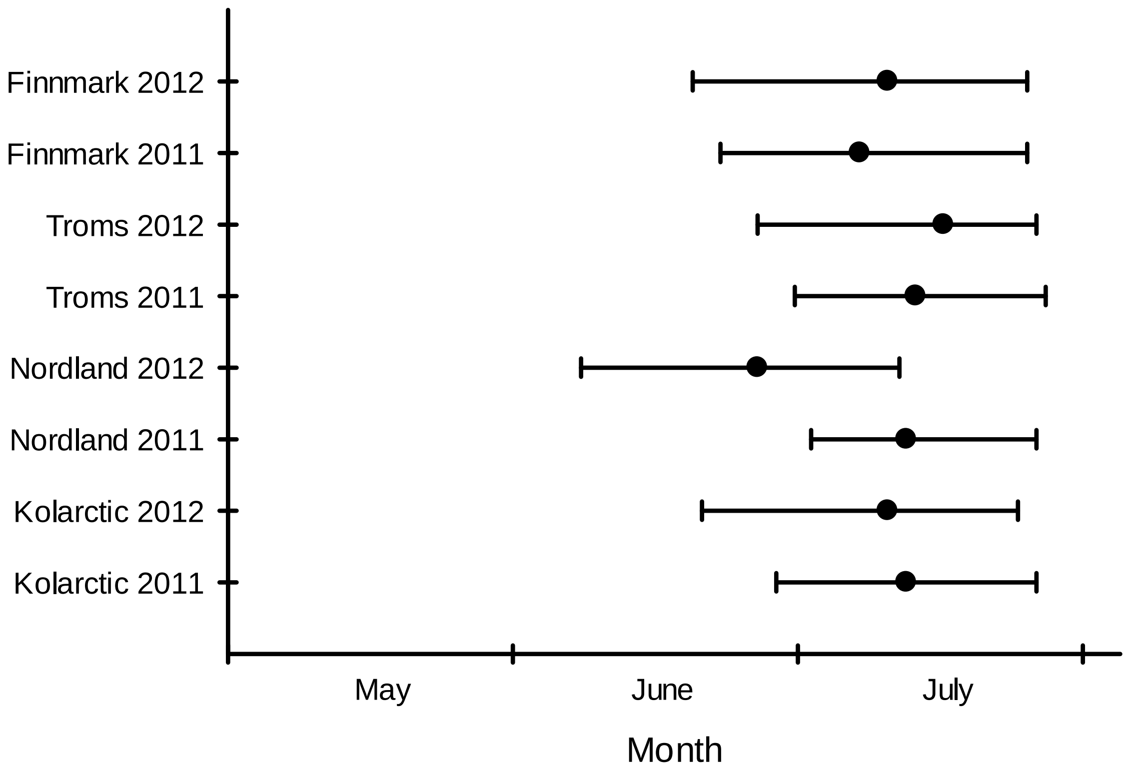



*Figure 16. Median dates with lower and upper quartiles of catches of escaped salmon in the entire Kolarctic salmon project area and separately in each of the three counties in the years 2011 and 2012. Samples are from the beginning of May to August 4.*

Figure 16 indicates that the interquartile ranges in the timing of escaped salmon catches are quite long. This time period covers the migration periods of 1SW salmon in three Northern counties in Norway.

*Photo 30. A salmon fisherman filleting a 2SW wild salmon.*

Median date of catch from the numbers of fish caught during the fishing period is a simple statistic method to compare spatial and temporal variations in the timing of migrations and of catches. Figure 16 indicates that in Troms and Finnmark migrations of escaped salmon took place a little later in 2012 than in the year 2011. The delay in timing was only a couple of days. Also maiden salmon indicated a little delay in the migrations in 2012 compared to the year 2011 in Troms and Finnmark. Materials from Nordland in the years 2011 and 2012 are not comparable with each other and that is weakening the value of the median date catches in the entire Kolarctic salmon project area in the year 2011. The upper quartile in the cumulative catches was reached c. July 25 and the rest 25% from the cumulative catches accumulated between July 25 and August 4.

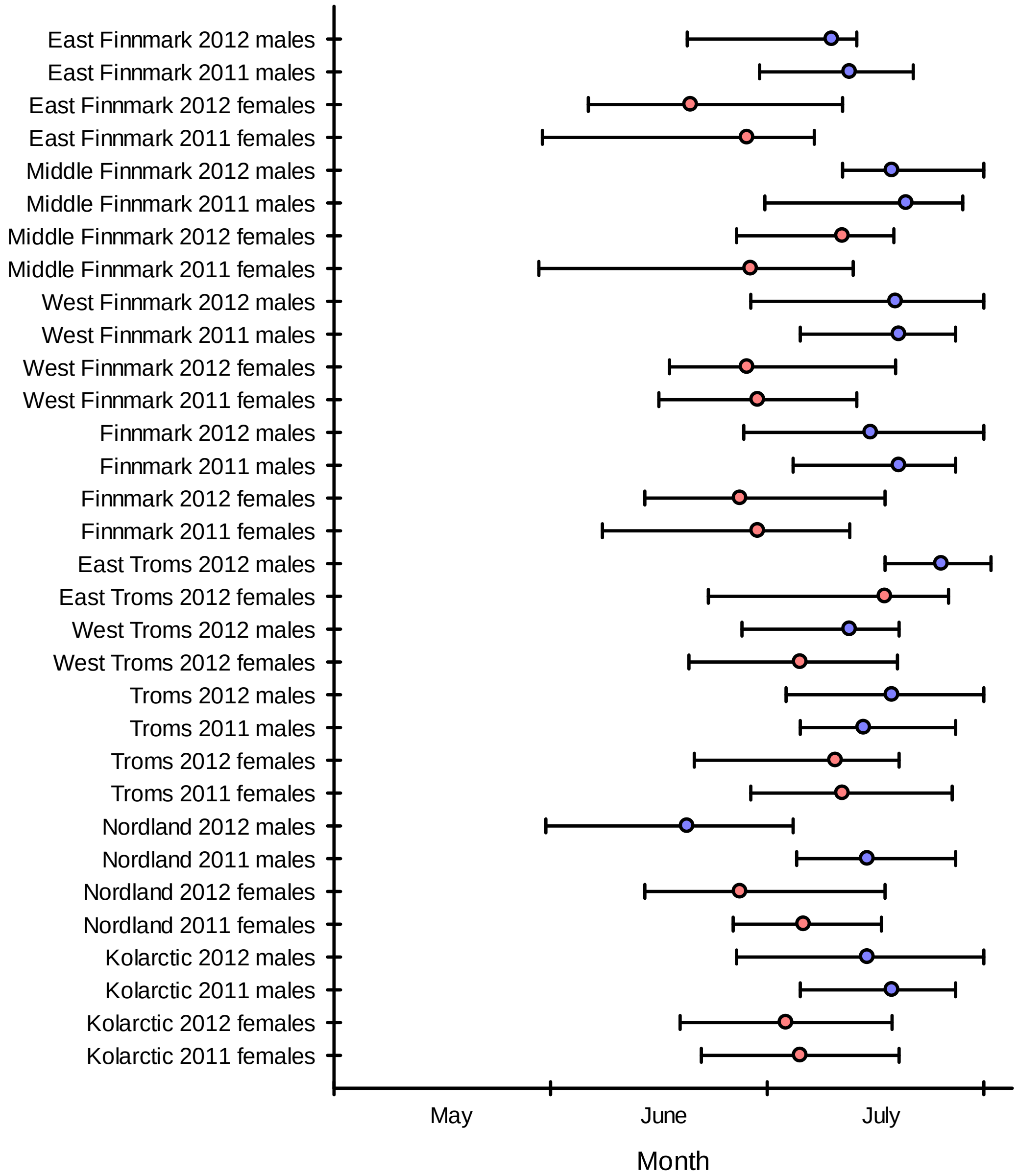



*Figure 17. Median dates of catches with lower and upper quartiles for escaped female and male salmon in the entire Kolarctic area, in each of the three counties and in smaller areas within Troms and Finnmark in the years 2011 and 2012 between May and 4 August.*

The median dates of catch of escaped salmon in different areas are indicating that female escaped salmon are migrating earlier than males. Difference in the median dates of catches between the sexes is one or two weeks (Figure 17). When the upper quartile is short compared to the lower quartile it indicates that the migration has clear peak and migration after that is almost over or at least declined markedly.

Figure 17 illustrates the summary of the migrations for escaped salmon in Kolarctic salmon project area. Female escaped salmon are migrating earlier than males in the entire Kolarctic area, in all the three counties and in all the smaller areas in Troms and Finnmark.

*Photo 31. Tore Eliassen from Porsangerfjord cleaning his bend net and throwing small one-sea-winter salmon into the boat. In the middle of July there is lot of vegetation that gets caught in nets.*

Figure 18 indicates that escaped salmon is occurring in the catches throughout the entire official fishing time from early June to begin of August. One reason to the lower occurrence of escaped salmon in the catches in May and after begin of August might be the lower fishing effort compared to the fishing in June and July. The abundance of escaped salmon in the catches in the outermost coastal area between Loppa and Nordkapp is high in the end of the bend net fishing season. It is interesting to observe that in Tanafjord within the Tana municipality area the abundance of escaped salmon was low like in Porsangerfjord in Porsanger municipality area.

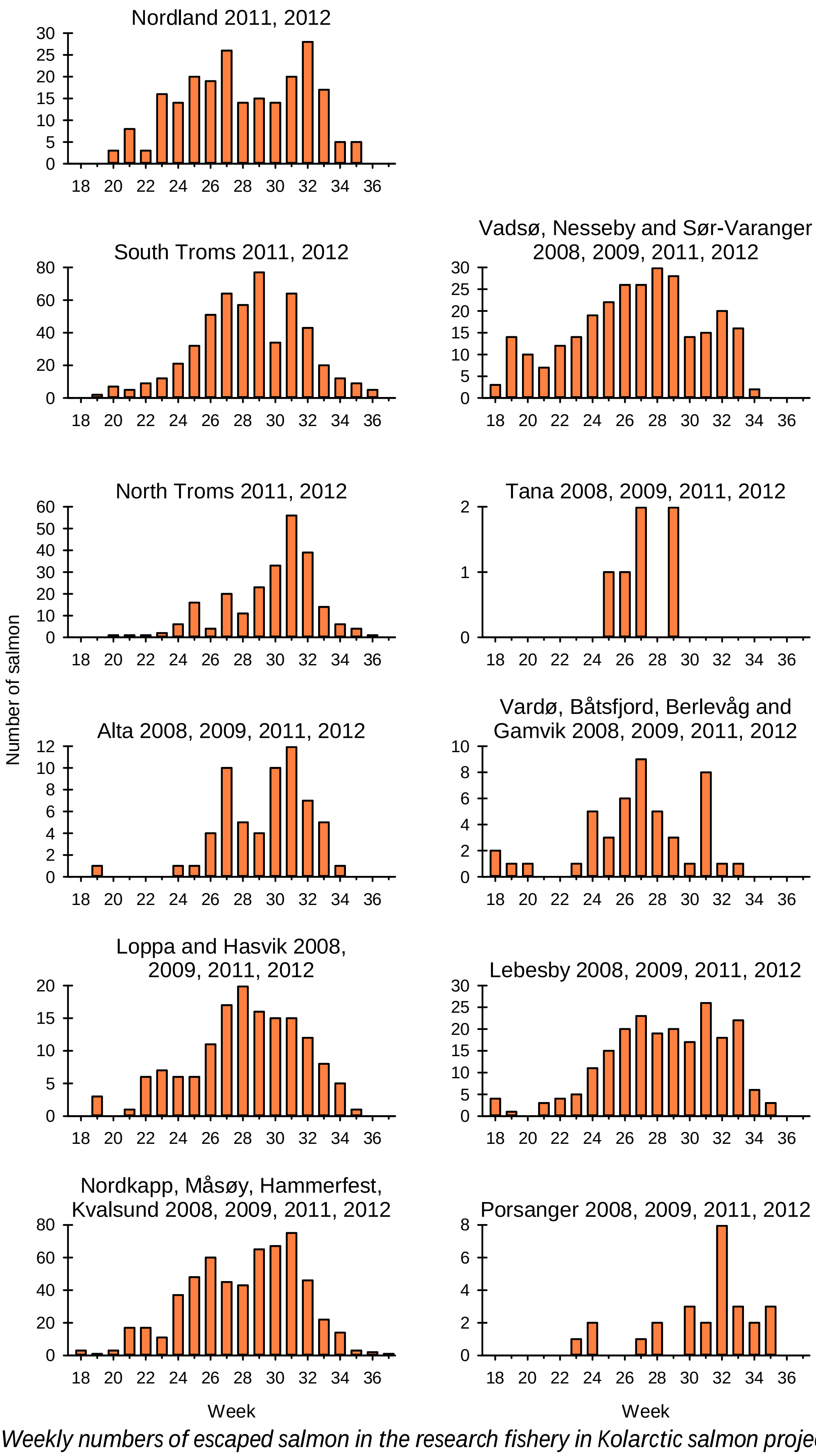



*Figure 18. Weekly numbers of escaped salmon in the research fishery in Kolarctic salmon project area.*

## *3.2 The proportion of females varies during the season and by the length of salmon*

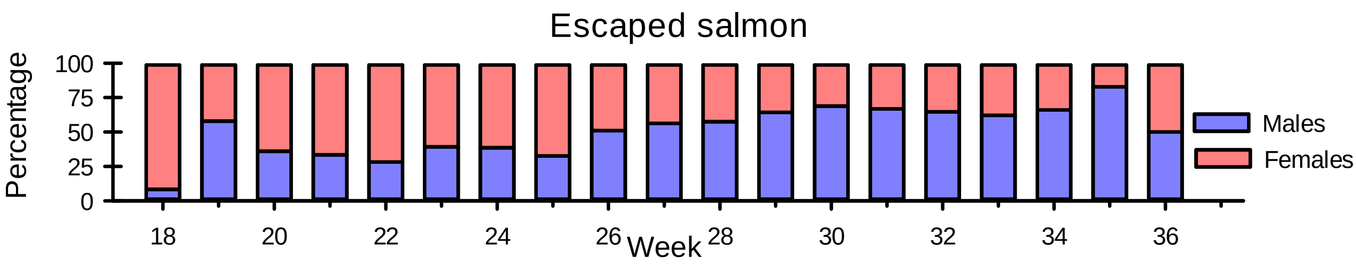



*Figure 19. The weekly sex distributions of escaped salmon in Kolarctic area in 2011-2012*

Females were the clear majority in the catches of escaped salmon when migrations commenced along the coastal lines (Figure 19). Slowly the proportion of males increased and males reached the clear majority of c. 75% of escaped salmon in the last week of July and thereafter the proportion stayed more of less stable. The earlier migration of females to the coastal areas indicates that they also ascended earlier into the rivers like wild female salmon is behaving in all sea-age groups.  In the Kolarctic salmon project area in escaped salmon the proportion of males exceeded that of females with 57% but in wild salmon females exceeded slightly with 51% the proportion of males during the whole research period from May to the end of September.

*Photos 32 and 33. The gonads of the female salmon on the left are in spawning condition for the year 2011 (eggs are filling most of the body cavity) indicating that she was on the way to her home river (mature salmon). The gonads of the female salmon on the right are in a low development stage indicating that she was not going to spawn during that summer (immature salmon). Perhaps this female salmon was on the way to ascend her home river this year and stay there over the winter and spawn the next year or she only followed mature females from ocean feeding grounds to the coastal areas.*

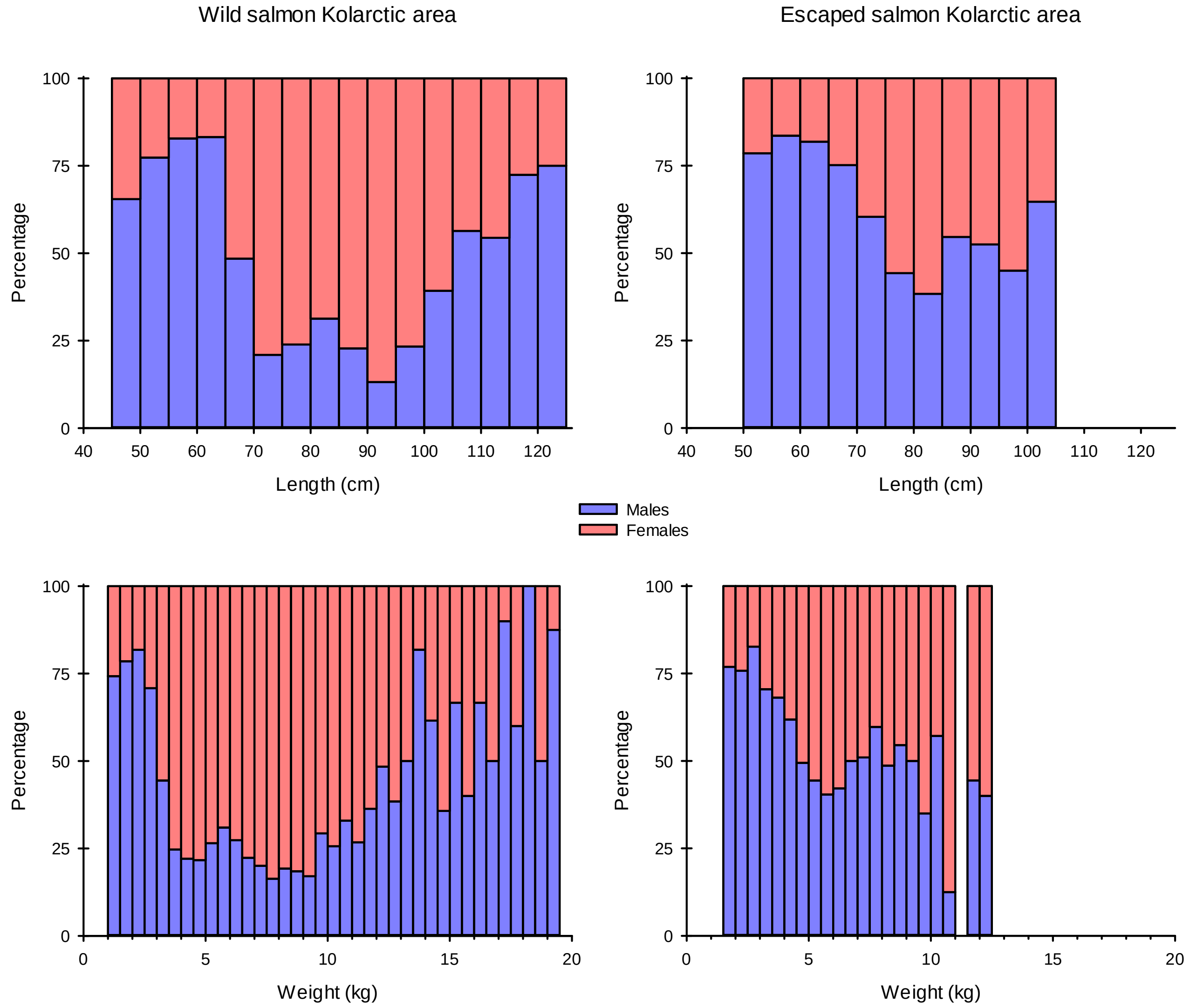



*Figure 20. Sex ratios for wild salmon of 1-4SW fish and previous spawners (figures on the left) and for escaped salmon (figures on the right) against weight and length of fish in the years 2011 - 2012 in the Kolarctic salmon project area in Norway.*

There are remarkable differences in the proportion of females in the medium sized fish between wild salmon and escaped salmon. The proportion of females is much lower in escaped salmon (c. 50%) compared to wild salmon (75%) when the size of fish is between c. 4 kg and 10 kg (Figure 20). Naturally, the difference is the same in the corresponding length groups. Sex ratios are clearly reflecting the sea-age groups in wild salmon but in escaped salmon it is not possible to determine the sea-age due to the irregular growth zones in the scales.

## *3.3 Maturity of escaped salmon versus maturity of wild salmon throughout the summer*

Early in May a quarter from wild 1-4SW female salmon was immature but in wild males the proportion of immature fish was c. 50% almost the entire May. In escaped male salmon the proportion of immature fish was like in wild salmon until the middle of June and thereafter the proportion was higher than in wild males (Figure 21). In escaped females the proportions of immature fish was higher than in wild female salmon until the second half of June and after that period escaped salmon was as mature as wild salmon. This indicates that all wild salmon as well as escaped salmon were mature in females and males in the end of summer.

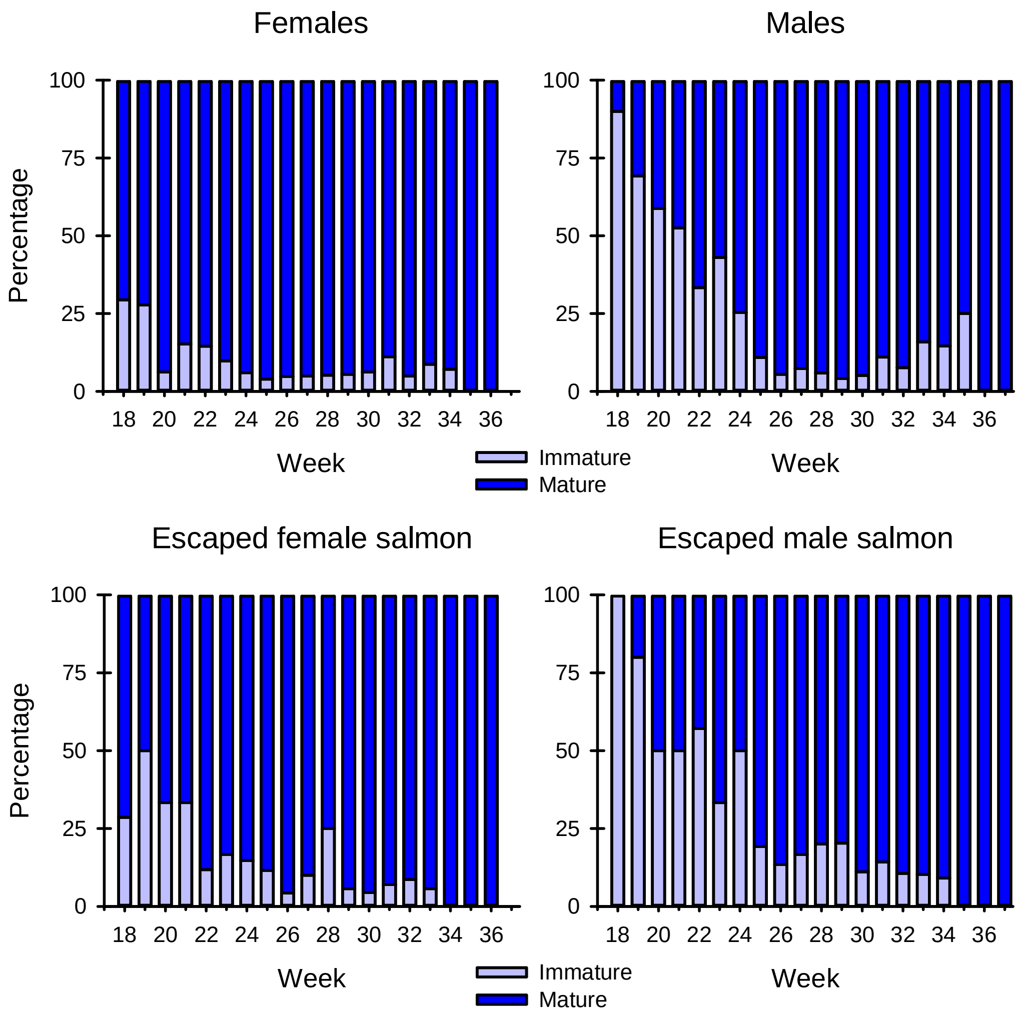
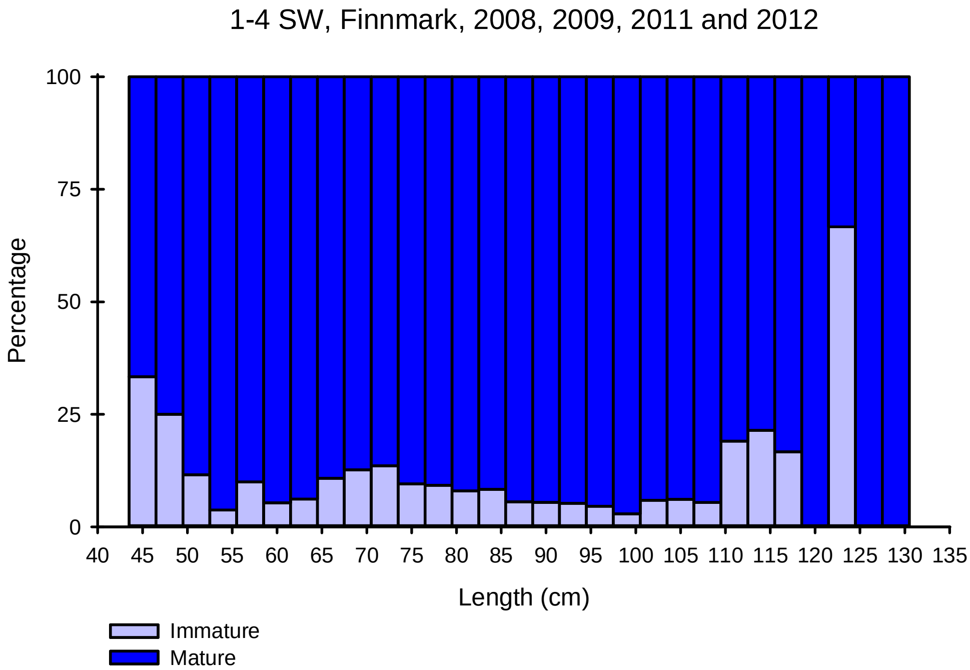



Figure 21. Proportions of mature and immature fish among females and males in the Kolarctic salmon project fishery in Finnmark the period from May to September in the years 2008, 2009, 2011 and 2012. Figure above is for wild 1-4SW salmon and figure below is for escaped salmon.

The proportions of immature fish were clearly larger for escaped salmon than for wild 1-4SW salmon in all the length groups between 55 cm and 100 cm (Figure 22).



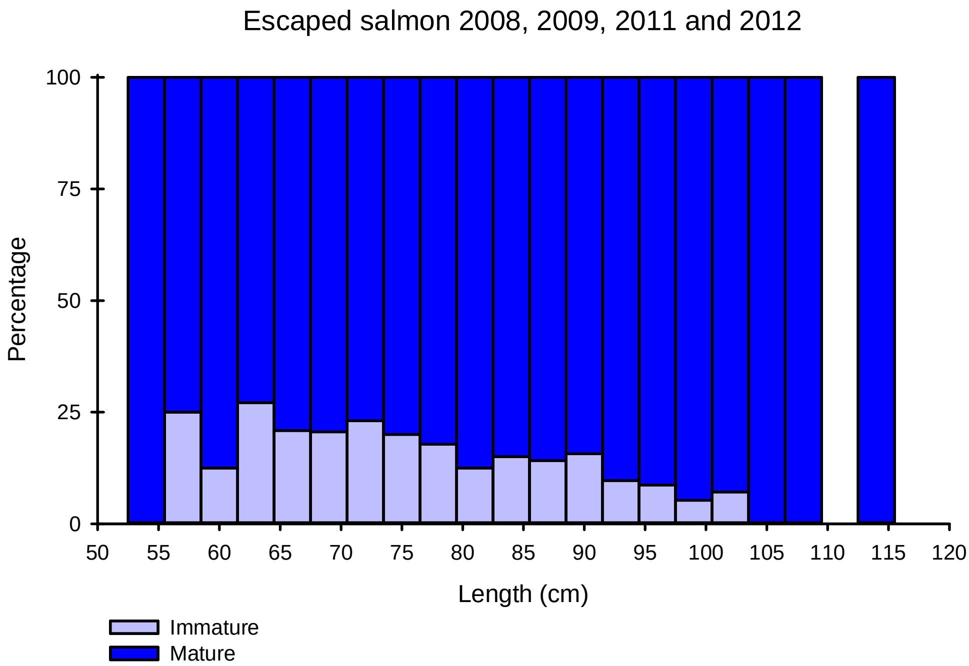




Figure 22. Proportions of mature and immature fish along the length for wild salmon (figure above) and for escaped salmon (figure below) females and males combined in the Kolarctic salmon project fishery in Finnmark in the period from May to September in the years 2008, 2009, 2011 and 2012.

## *3.4 The mean size of escaped salmon exceeds that of wild salmon*

*Photo 34. Palmer Johnsen, Havøysund, counting the numbers of sea lice on salmon.*

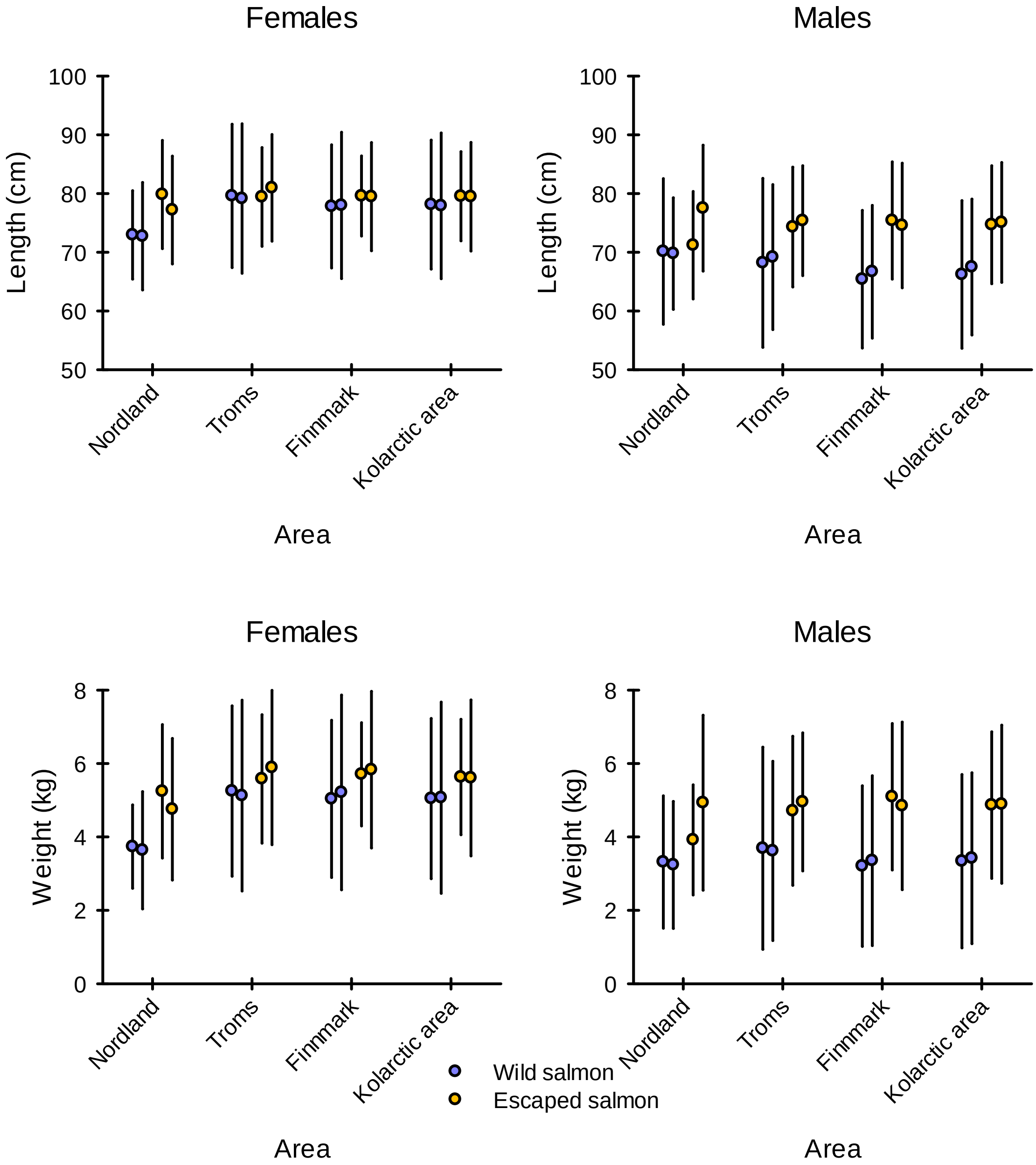



*Figure 23. Mean sizes of wild and escaped salmon in the catches from May to the end of September. Plots on the left represent data from the year 2011 and plots on the right represent the year 2012.*

Mean sizes of escaped salmon caught during the research period were almost the same in both years. Mean lengths and weights of female escaped salmon were larger than those in male escaped salmon in all counties and in the entire Kolarctic salmon project area (Figure 23). Mean lengths and weights of wild salmon were smaller than those of escaped salmon in all areas and that was true of both sexes. The condition of escaped female salmon was better than that of wild salmon. Escaped salmon were fatter compared to the same length of wild salmon. Reason for that must be the selective breeding in cage culture when developing salmon for farming purposes. The weight of wild salmon is lower compared to the weight of the same length of escaped salmon. Length- weight curves are clearly informing the higher condition factors for escaped salmon than for wild salmon in females and males (Figure 24).

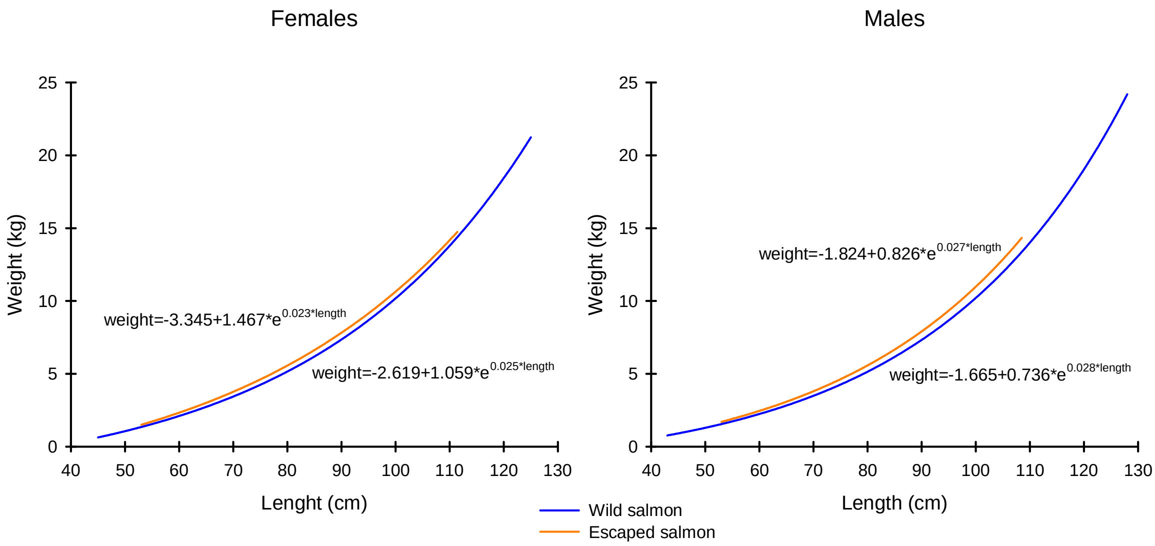



Figure 24. Length- weight curves for females and males in wild and escaped salmon from the Kolarctic salmon project material in 2011 and 2012.

*Photo 35. Large escaped salmon caught in the River Vestre Jacobselva by Terje Holm (in the photo), Finnmark, on August 15th 2011. Weight of this male salmon was 16.5 kg and it was one of the largest escaped salmon reported.*

*Photo 36. Cage culture on the southern side of Varangerfjord, opposite side of the River Vestre Jakobselva.*

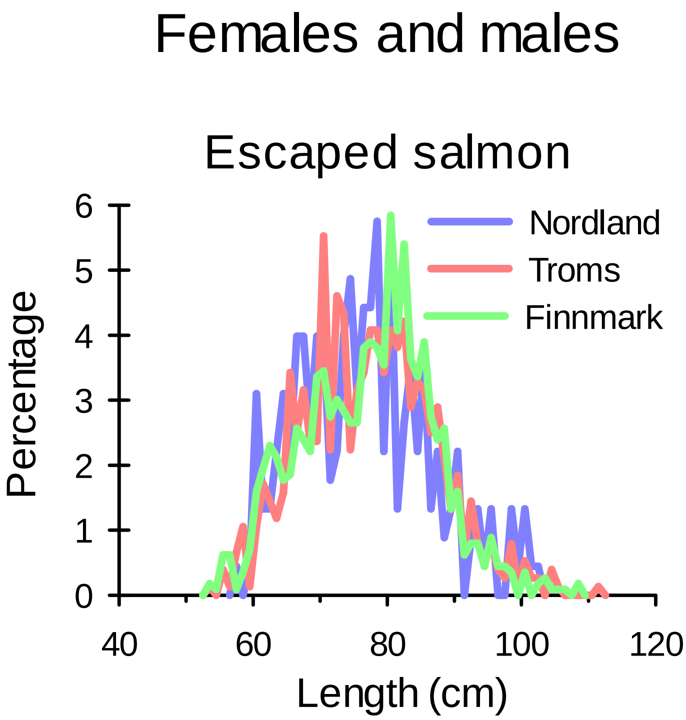



*Figure 25. Length distributions of escaped salmon had clear overlapping within the three counties.*

Although the size of escaped salmon varied largely in Kolarctic salmon project area their length distributions were almost the same in all the three counties (Figure 25). Length and weight distributions of escaped and wild salmon were clearly different (Figure 26). Three different sea-winter salmon age groups (1SW, 2SW, 3SW) occurred clearly in wild female and one sea-winter salmon age group (1SW) in wild male salmon length distributions.

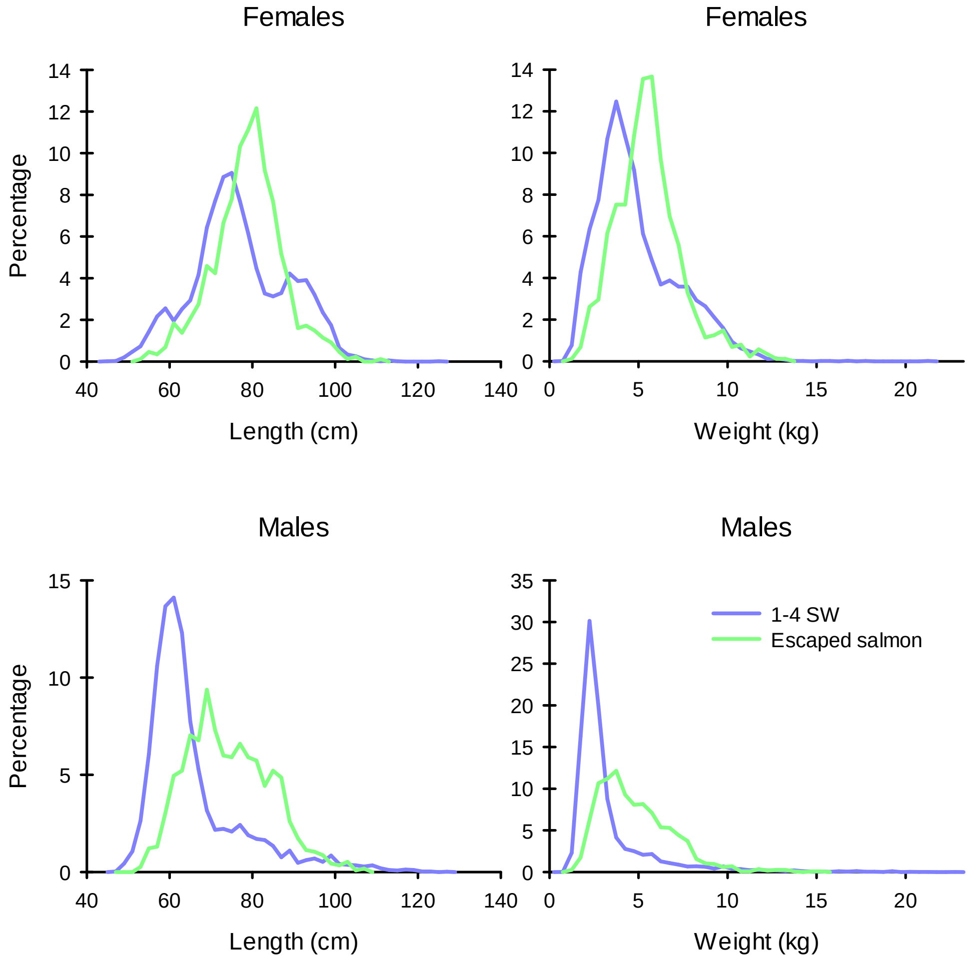



*Figure 26. Length and weight distributions of wild and escaped salmon in Kolarctic area.*

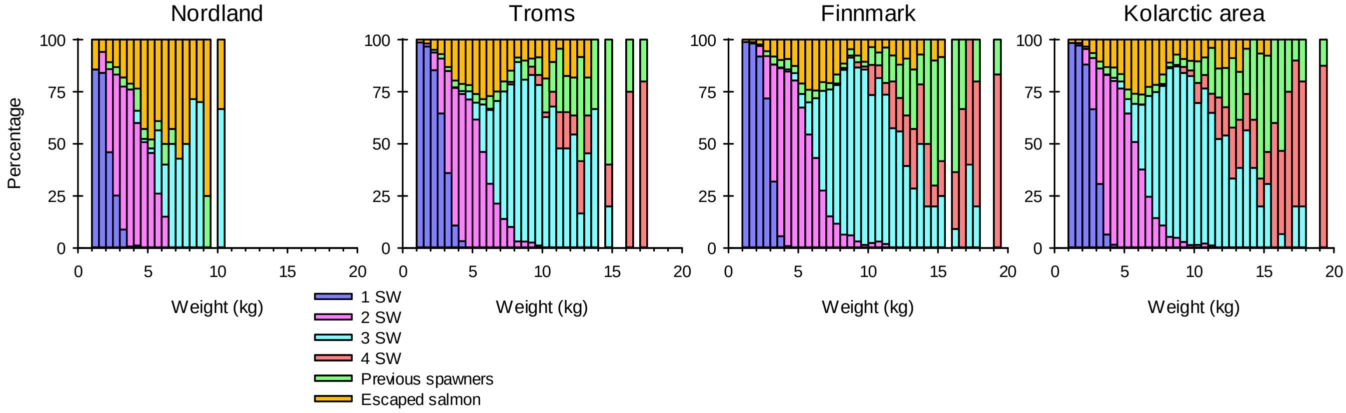



*Figure 27. Percentage distributions of different sea-ages for wild and escaped salmon in size groups in Kolarctic area in 2011-2012.*

Figure 27 illustrates the wide overlapping of different sea-age groups of wild salmon and escaped salmon within the same size groups. Escaped salmon occur in the catches together with all the sea-ages of wild salmon and that makes it more difficult for fishermen to detect escaped salmon compared to the situation were escaped salmon would occur only in a certain size group. In Nordland 50% of salmon in the size group of 5-8 kg were escapees and in Finnmark the percentage was 20%-25%. This means that on average every fourth salmon in the size category of 5-8 kg fish was escaped salmon in Finnmark in the period between May and the end of August (Figure 28).

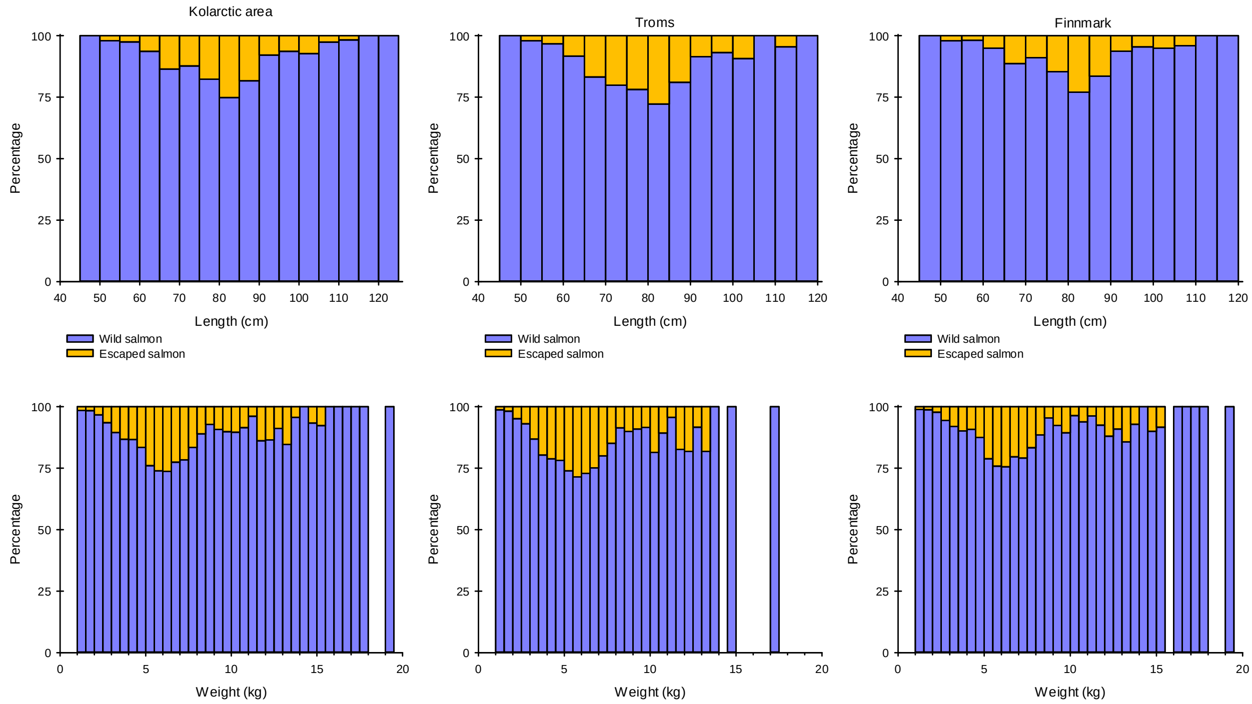



*Figure 28. Proportions of escaped salmon within size groups of salmon caught in Kolarctic salmon project area in 2011-2012.*

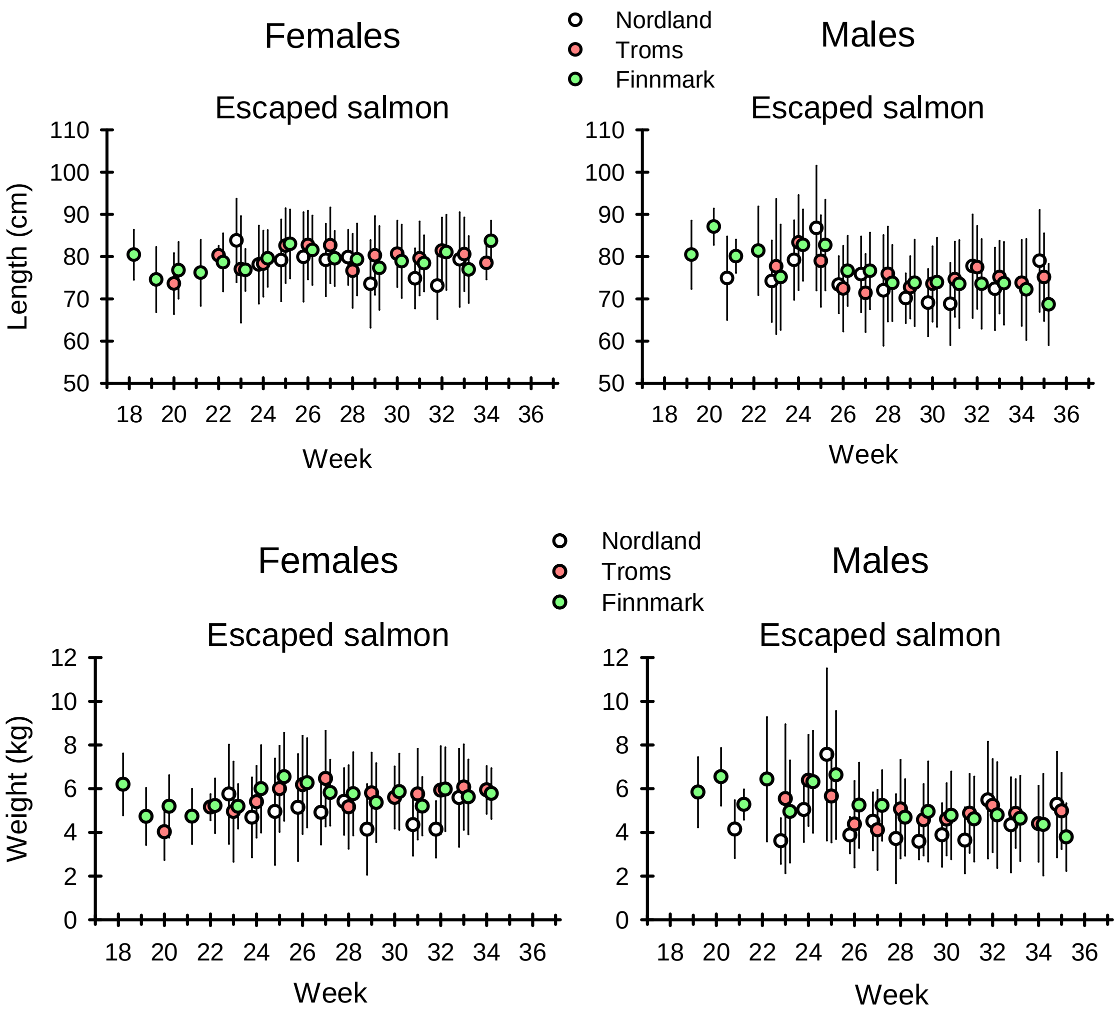



*Figure 29. Mean weekly lengths and weights (SD) of escaped salmon in Kolarctic salmon project area. Material from the years 2011- 2012 combined.*

Mean lengths and weights of female escaped salmon were almost the same during the whole summer in Troms and Finnmark while exceeding those in Nordland. In males mean lengths and weights, however, declined slowly towards the autumn (Figure 29). More clearly this declining is observed in the figure 30 for escaped males and especially for wild males. In wild salmon migrations older males with larger length and weight are ascending first to the coastal areas followed by 1SW fish and therefore mean lengths and weights of males decline towards autumn. In cage cultured salmon there are two types of males. Some males reach spawning condition after a longer sea life period and some males reach spawning condition after a shorter sea life period and therefore these two types might have different migration patterns. This can affect the mean sizes of escaped male salmon during the summer. Salmon that are used in cage culture reach maturity in older age and especially in males that might be the reason why the mean size does not decline during the summer like in wild mature males. The selective breeding in smolt production for cage culture is likely to have caused the increased age and/or size of maturity in escaped male salmon.

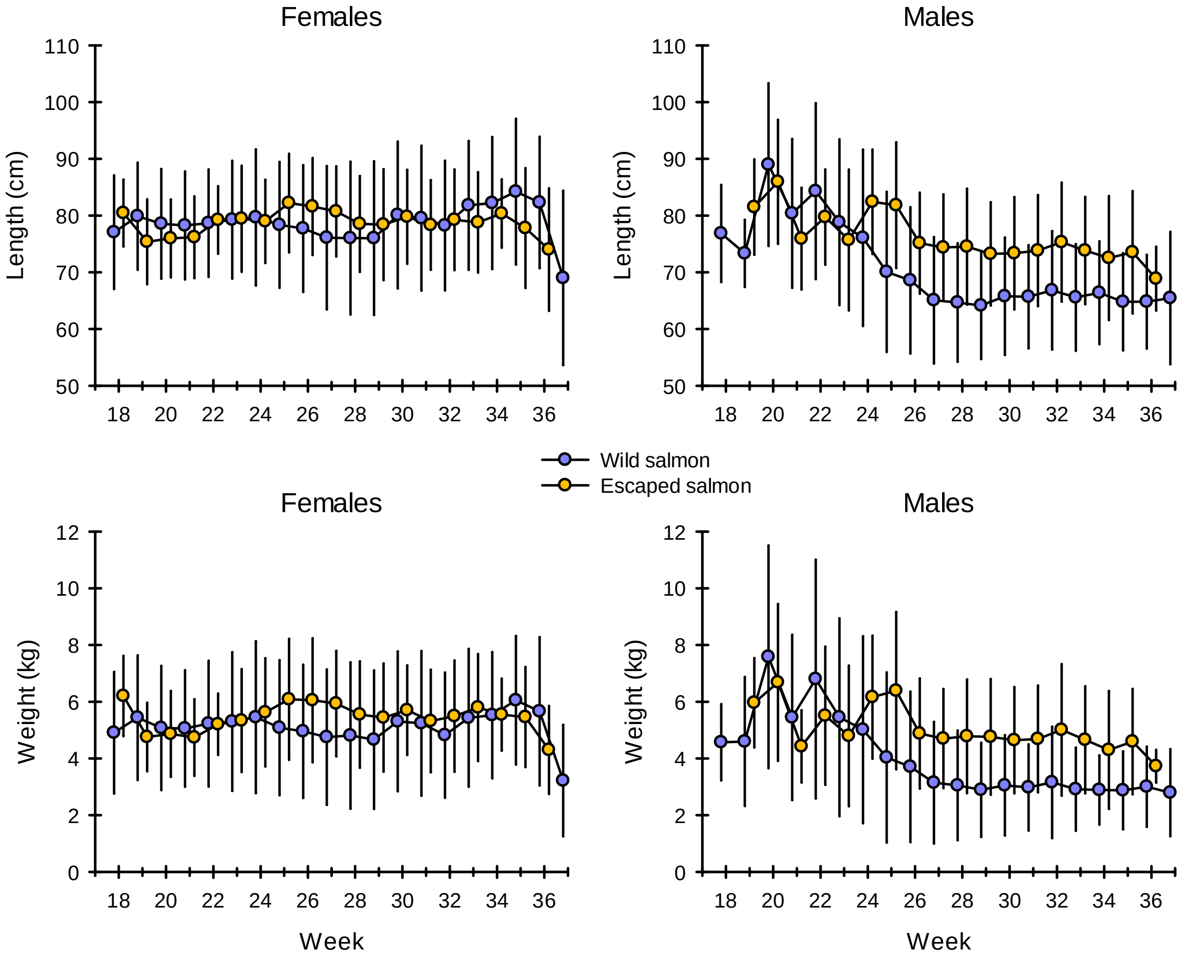



*Figure 30. Mean weekly sizes of female and male wild and escaped salmon in Kolarctic salmon project area in 2011-2012.*

*Photo 37. An escaped salmon caught by Øystein Kristiansen, Nesseby*

*Photo 38. Professional salmon fisherman Leif Ingilæ cleaning his bend net in Sør-Varanger,Bygøynes.*

*Photo 39. Ansten Mathisen, Havøysund*

### *3.5 Identifying escaped and wild salmon by experienced salmon fisherman and experienced salmon scale reader*

Salmon fishermen recognized only 57% from the real escaped salmon in 2012 and researcher recognized the lacking 43% from the salmon scale structure (Figure 31). Very seldom fishermen mistook wild salmon for escaped salmon. In 2012 there was some improvement in the identifying of escaped salmon in Nordland and Troms which might be attributed the fact that some new fishermen were included into the research fishery that year. Anyway, it was a little surprising that in an area like Nordland where there are high numbers of escaped salmon at sea and in the rivers, fishermen could not identify escaped salmon better. In Finnmark the percentage of identifications made by fishermen declined which might have been caused by including of new inexperienced fishermen.

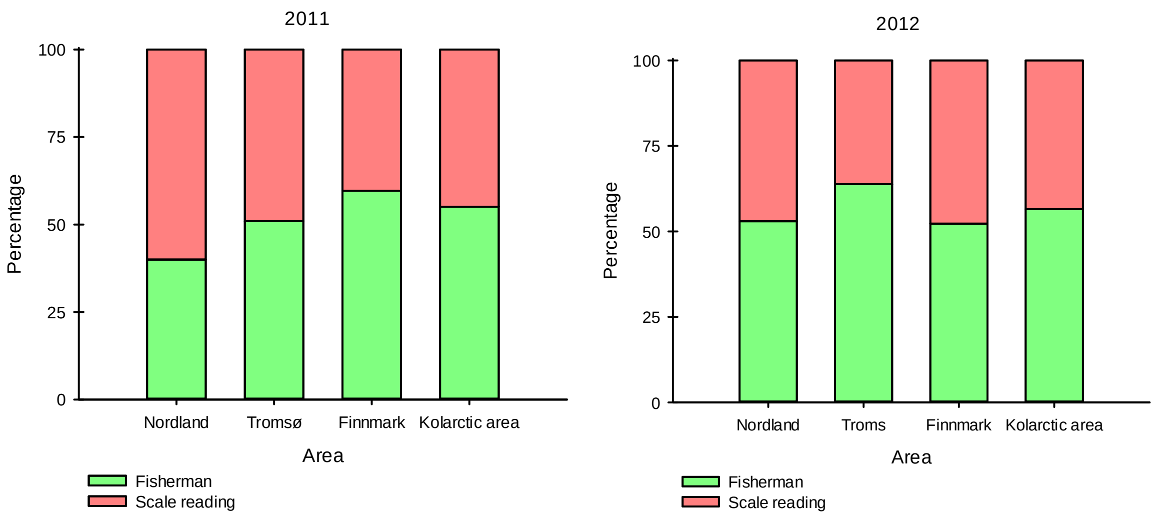



*Figure 31. Proportions of escaped salmon identified by fisherman and additional escaped salmon found by scale reading 2011 and 2012.*

In general fishermen did not succeed to identify well salmon as escaped fish, if the salmon were small. However when the length and weight of the salmon increased the fishermen's ability to identify escaped fish improved. The best identification percentage they reached with the salmon weighting of 6.5 kilograms which corresponds with the length of c. 80 cm (Figure 32).

The reason to the low identification percentage for smaller fish is that those salmon have not been in cages for a long time before they have escaped. Staying in a cage for a shot time does not make large erosions into fins which is one criteria in identifying escaped salmon. Also other characteristics that are used to identify escaped salmon are not so visible in small salmon. On the other hand in the largest escaped salmon the fins have renewed a little and it also makes identifying escaped salmon more difficult which can also decline the percentage.

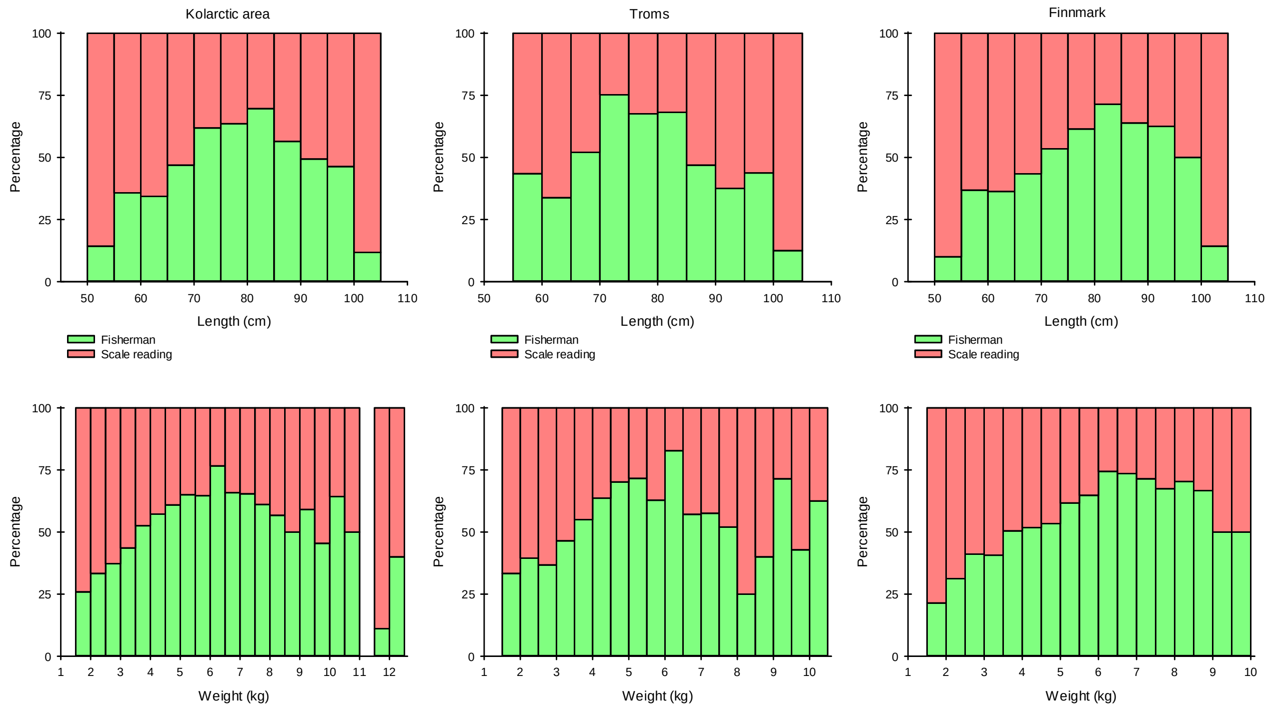



*Figure 32. The development of the identification percentage with the length and weight by salmon fishermen to the escaped salmon and by experienced salmon scale reader in 2011-2012*

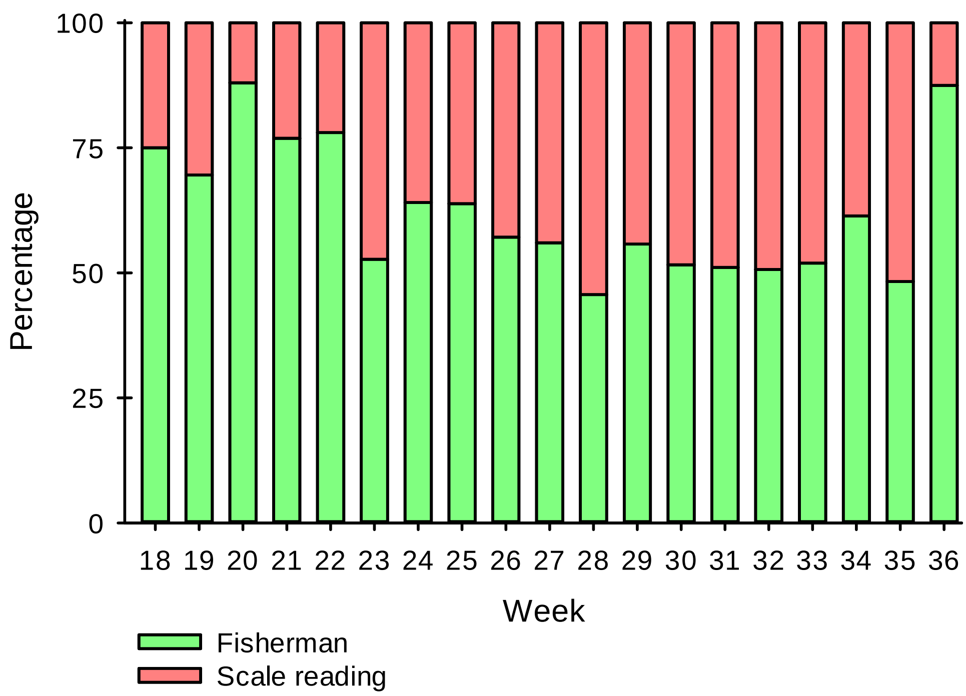



*Figure 33. The development of the recognizing percent with the week in summer by salmon fishermen and by experienced salmon scale reader.*

Early in the season in May and June with lower number of salmon in the catches the fishermen's identification percentage was higher (Figure 33). The reason for that is that fishermen had more time to make observations on individual salmon early in the season. When the numbers of salmon in the catches increased fishermen did not have so much time to use on individual salmon and maybe therefore the identification percentage declined to the level of 50 % by the end of July.

*Photos 40 and 41. Salmon lice are usually hanging in sheltered areas of the fish body like behind the dorsal fin (photo on the left) or on the sides of pectoral fin (photo on the right).*

*Photos 42 and 43. A salmon sea louse hanging on the scales (photo on the left) and wounded area above the pelvic fin (photo on the right).*

## *3.6 Salmon lice; occurrence in wild and escaped salmon*

Salmon lice (*Lepeophtheirus salmonis*) is a common parasite on salmon. It is a copepod species and therefore belongs to the large group of *Crustacea*. Salmon lice occur at sea in the northern hemisphere. This parasite lives on the surface (above the scales) of salmon and therefore it is called an ektoparasite. The larvae of this parasite can attach themselves to the salmon already in a very early phase of salmon's sea life as a smolt or post smolt or it can attach into post-spawneres, kelts, which usually are in poor condition after descending from their spawning rives into the sea for recondition. The parasites mainly attach onto places of the fish's body where they are "sheltered" from the water current. The parasite feeds off the mucus on fish skin and also sucks blood from its host. If the number of parasites is high it can negatively affect the survival and growth of their host. Parasites can also carry bacterial and viral diseases that can be transported to wild salmon stocks from salmon cage culture. The occurrence and abundance of salmon lice on salmon can be informed using different indexes when studying temporal and spatial differences. In this Kolarctic salmon research the study of salmon lice was combined to other biological measurements from salmon catches done by professional fishermen. Here we have to remind that all the lice counts presented here are minimum mean values because fishermen did not have experience to count the smallest parasites on salmon. It is known that juvenile salmon, when they have reached the smolt phase, are leaving their rivers of origin and they are ascending to the sea. In seawater smolts can be infected by larvae of salmon lice and if smolts are infected with high number of lice larvae they will have high mortality during their early sea phase. Figures presented here can be used as a reference from the counting's of professional fishermen, not at all like professionals, and seeing possible differences between areas and within salmon in different life history stages like in different sea-ages, wild or escaped salmon, maiden salmon or previous spawners. Figure 34 indicates that the mean numbers of lice in maiden 1-3SW salmon is varying especially in Nordland County, secondly the mean numbers of lice are higher in Nordland than in Finnmark County where it is lower fish farming activity. Previous spawners had surprisingly high mean number of lice in July in Nordland County and in August in Troms County.

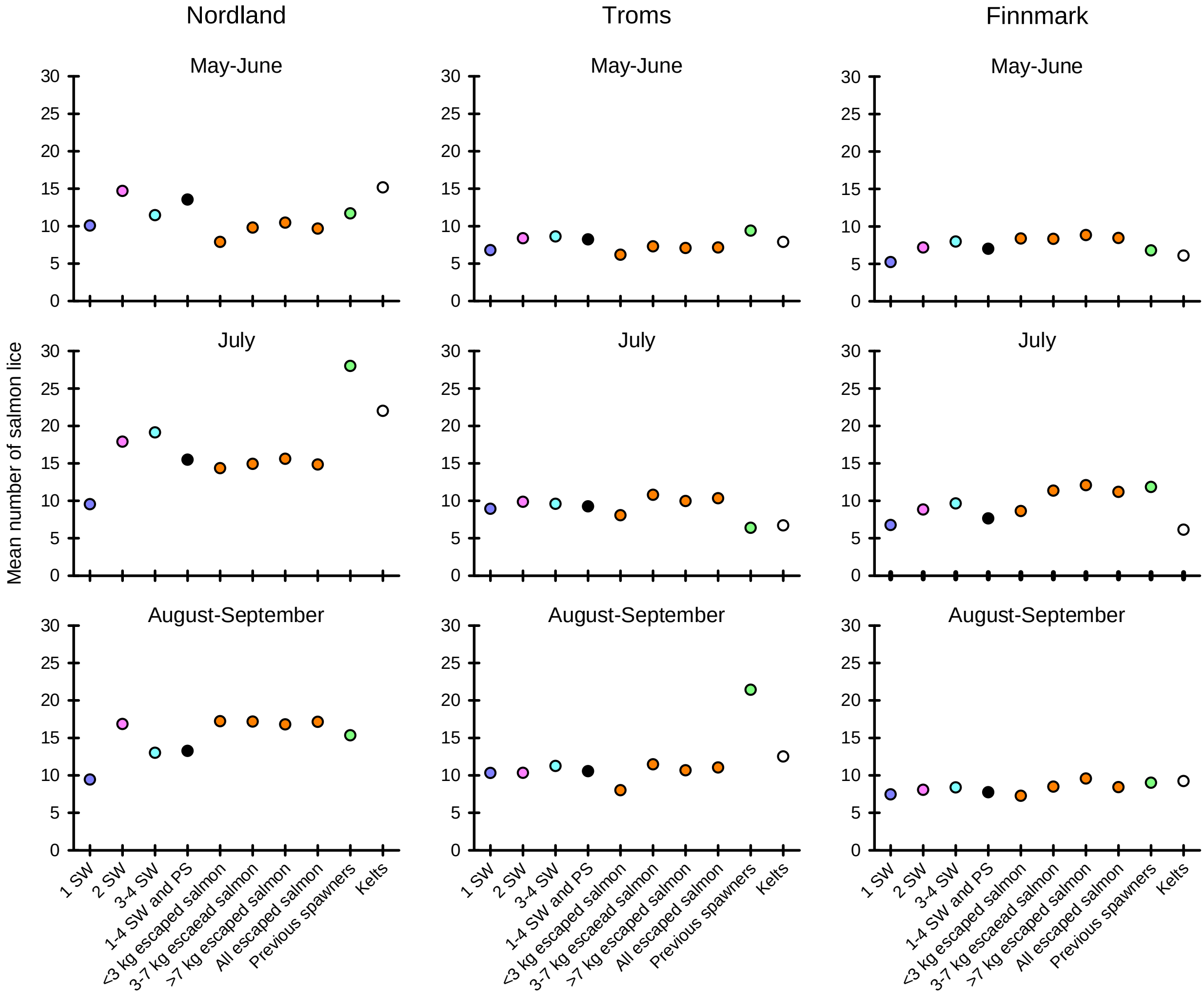



*Figure 34. Mean numbers of salmon lice for 1-3SW wild salmon, kelts and previous spawners as well as for escaped salmon of three sizes corresponding three sea-ages of wild salmon in Northern Norway in the Kolarctic salmon research fishery in 2011 and 2012.*

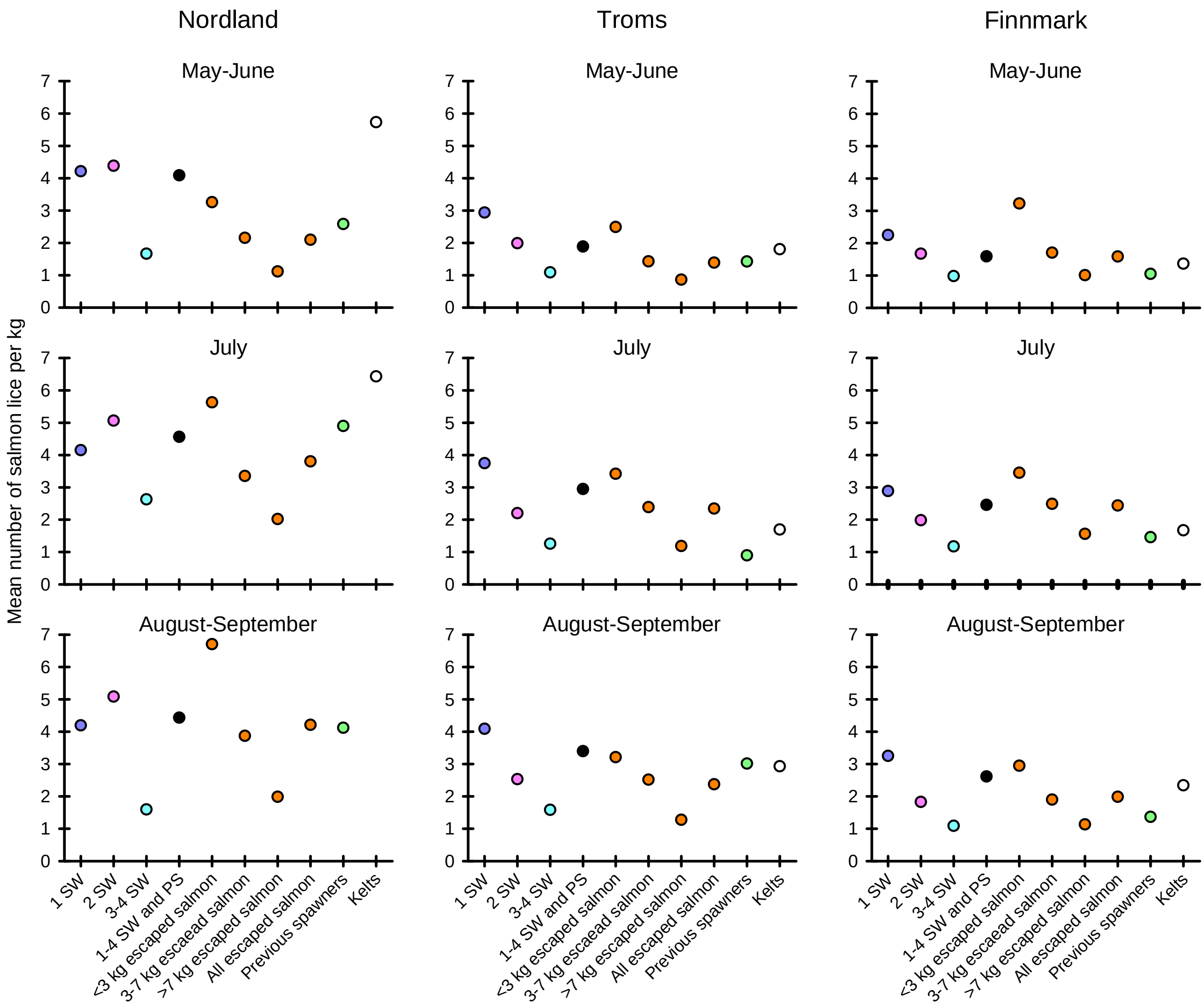



*Figure 35. Mean numbers of salmon lice per kilo fish for 1-3SW wild salmon, kelts and previous spawners as well as for escaped salmon of three sizes corresponding three sea-ages of wild salmon in Northern Norway in the Kolarctic salmon research fishery in 2011 and 2012.*

Number of salmon lice per kilo fish is more informative measure on the infestation level (Figure 35). The levels of infestation are clearly highest in Nordland for wild salmon throughout the summer months and rates are declining towards east, towards Finnmark County. Figure 36 draws clearly conclusion from the figure 35 showing the highest infestation rates in Nordland and also the trends that numbers of lice are increasing towards autumn.

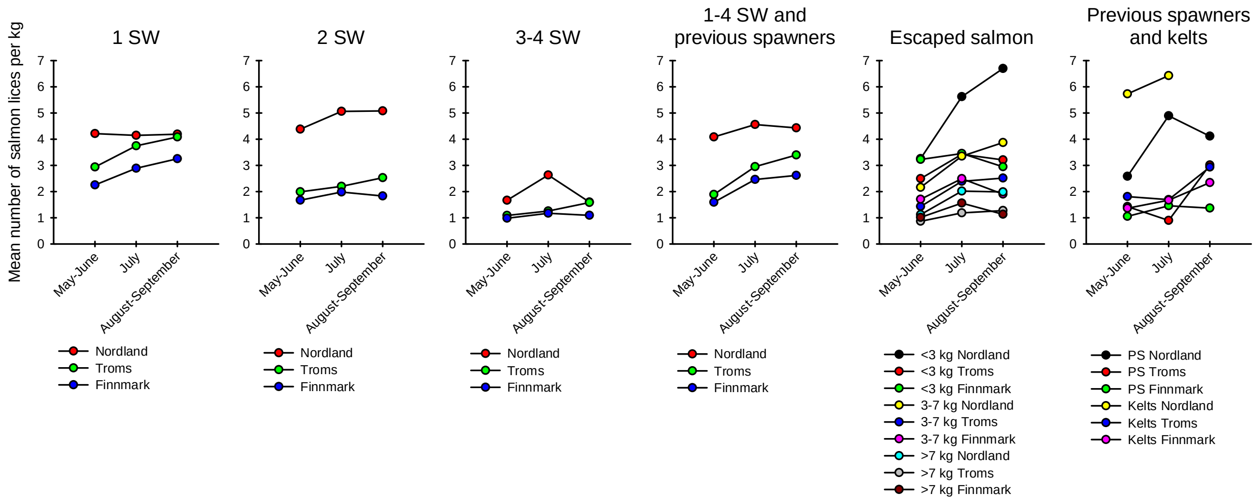



*Figure 36. Mean numbers of salmon lice per kilo fish for 1-3SW wild salmon, kelts and previous spawners as well as for escaped salmon of three sizes corresponding three sea-ages of wild salmon in Northern Norway in the Kolarctic salmon research fishery in 2011 and 2012.*

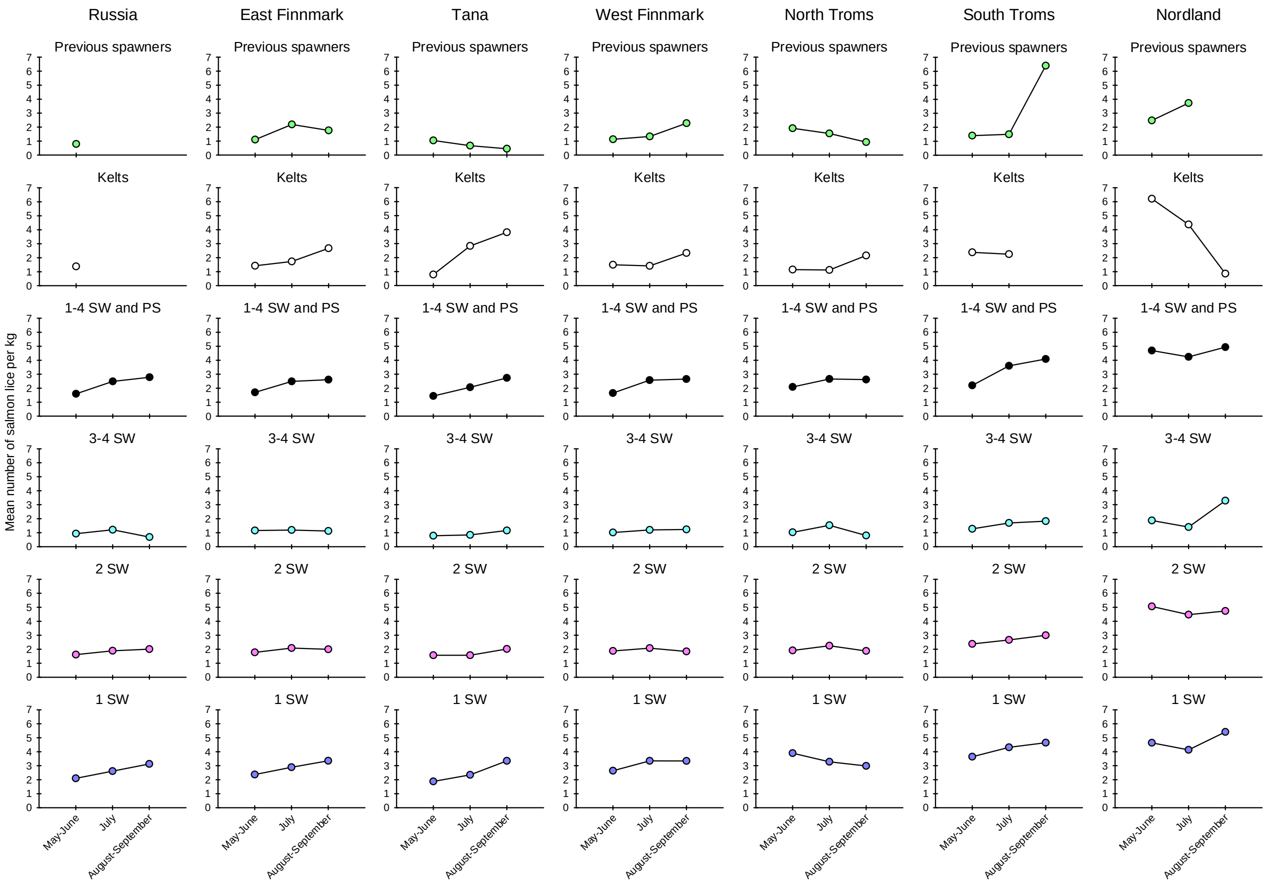



*Figure 37. Mean numbers of salmon lice per kilo fish for those salmon stocks which have their origin in seven Regional Group areas in Northern Norway and Russia. Mean numbers of lice are for 1-3(4)SW wild* salmon,

kelts and for previous spawners which were caught in Northern Norway in the Kolarctic salmon research fishery in 2011 and 2012.

In salmon belonging into salmon stocks which have their rivers of origin in seven Regional Group areas, the mean numbers of lice are increasing from May-June towards autumn (Figure 37). In all maiden salmon sea-age groups and slightly also in previous spawners the mean numbers of lice are increasing towards west, where the salmon cage culture is much more intensive than in Finnmark. It's known that in the coastal areas there are many stocks mixed together during summer when they are migrating towards their home river and still there are differences between counties in the infestation rate. More accurate data was available in Kolarctic salmon project where it was possible to study and compare spatial and temporal stock specific infestation rates (Figure 38-43). Although the numbers of lice per kilo salmon varied clearly for 1SW and 2SW salmon stocks between the neighboring rivers the numbers of lice were higher in those salmon stocks which located further west compared to the stocks in Finnmark.

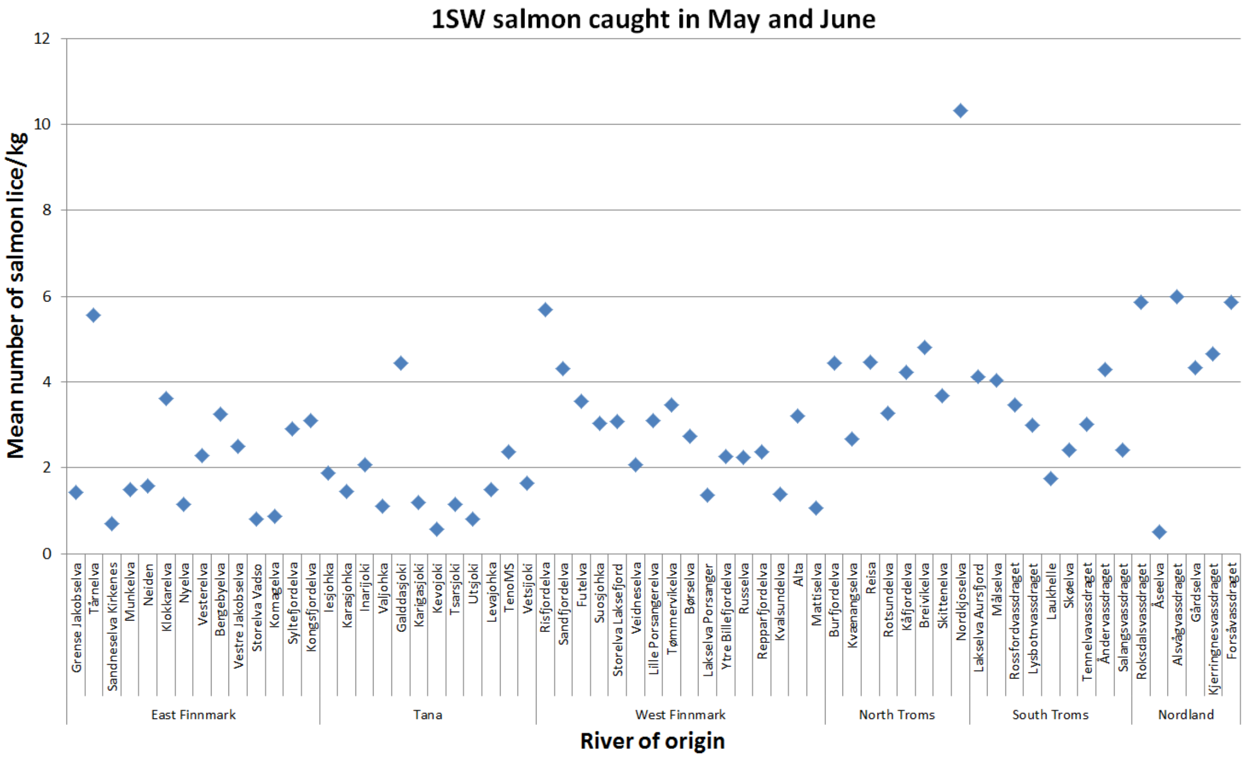



*Figure 38. Mean number of salmon lice per kilogram of 1SW salmon originating from different rivers caught in May and June combining materials from the years 2011 and 2012 in Northern Norway.*

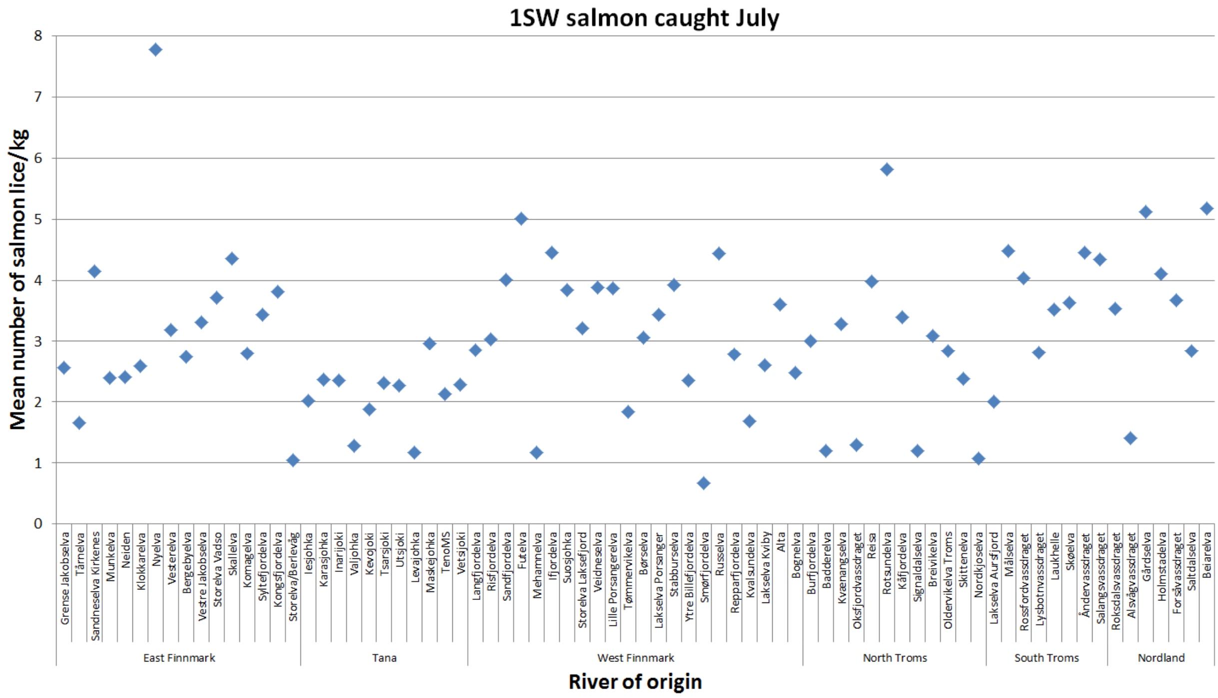



*Figure 39. Mean number of salmon lice per kilogram of 1SW salmon originating from different rivers caught in July combining materials from the years 2011 and 2012 in Northern Norway.*

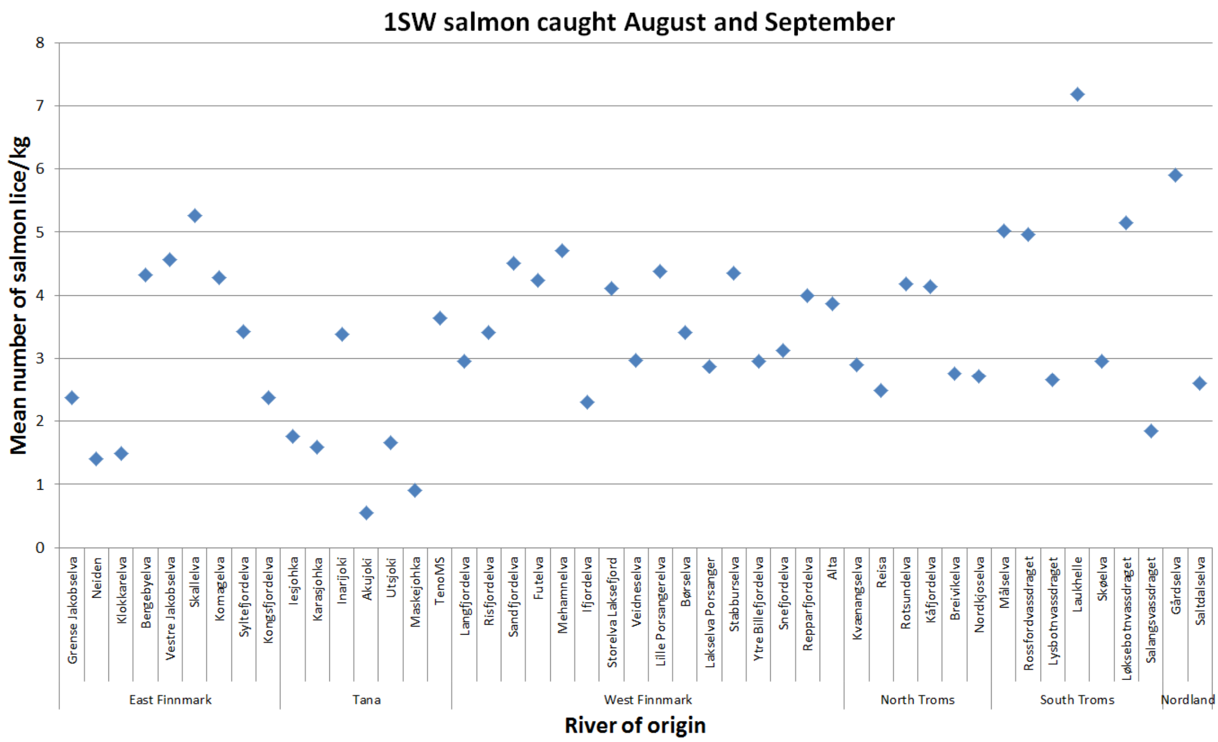



*Figure 40. Mean number of salmon lice per kilogram of 1SW salmon originating from different rivers caught in August or September combining materials from the years 2011 and 2012 in Northern Norway.*

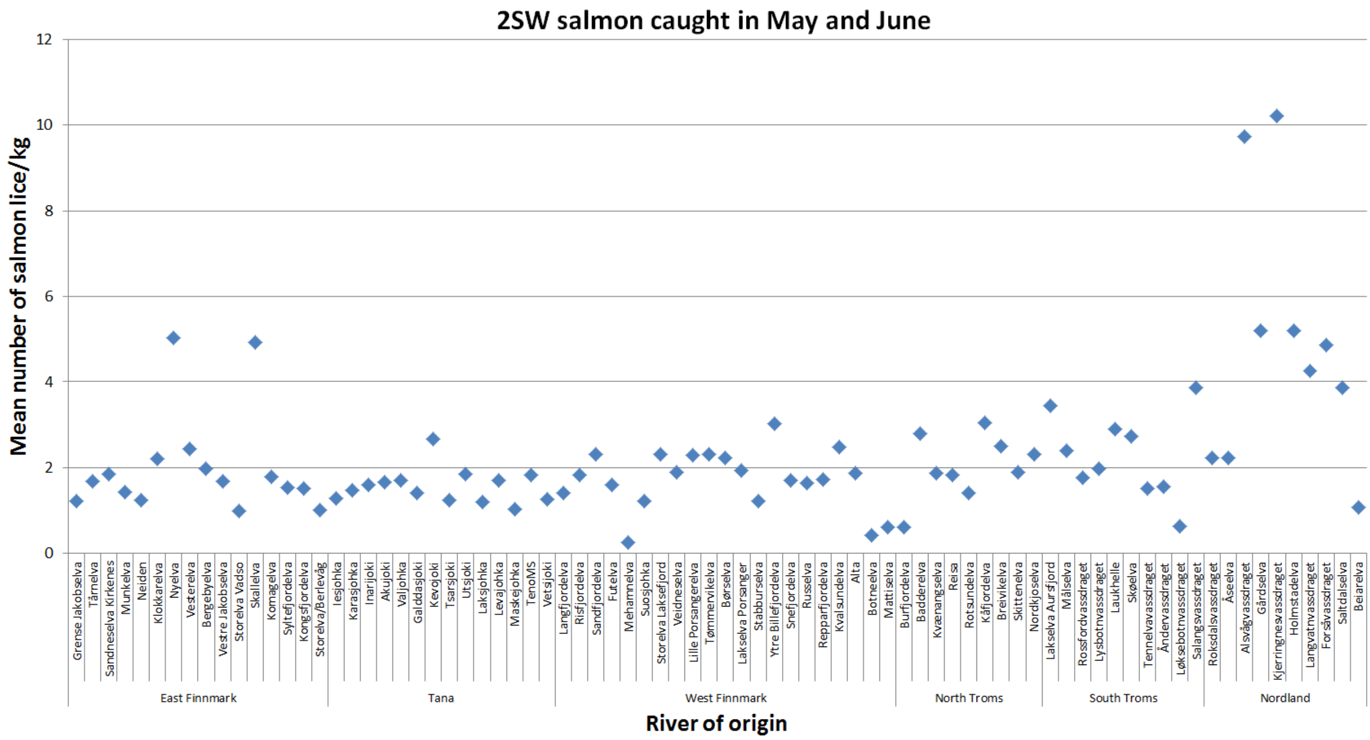



*Figure 41. Mean number of salmon lice per kilogram of 2SW salmon originating from different rivers caught in May or June combining materials from the years 2011 and 2012 in Northern Norway.*

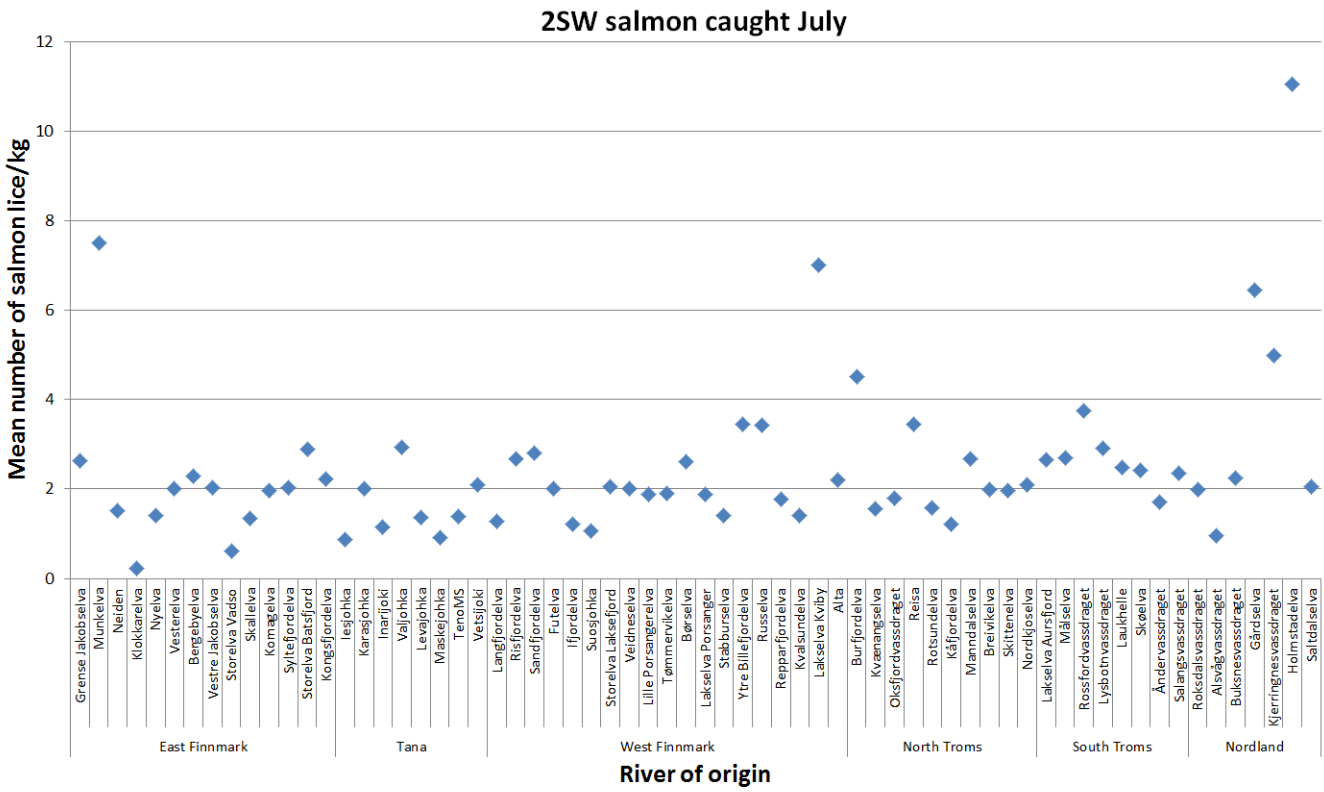



*Figure 42. Mean number of salmon lice per kilogram of 2SW salmon originating from different rivers caught in July combining materials from the years 2011 and 2012 in Northern Norway.*

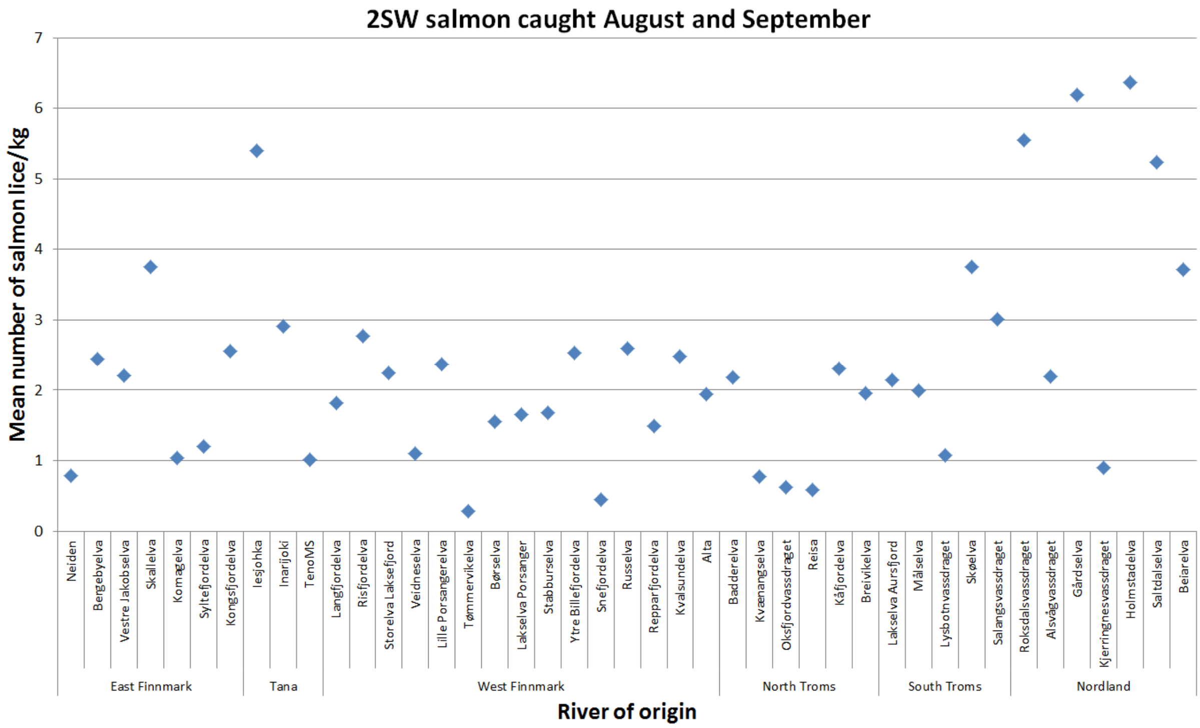



*Figure 43. Mean number of salmon lice per kilogram of 2SW salmon originating from different rivers caught in August or September combining materials from the years 2011 and 2012 in Northern Norway.*

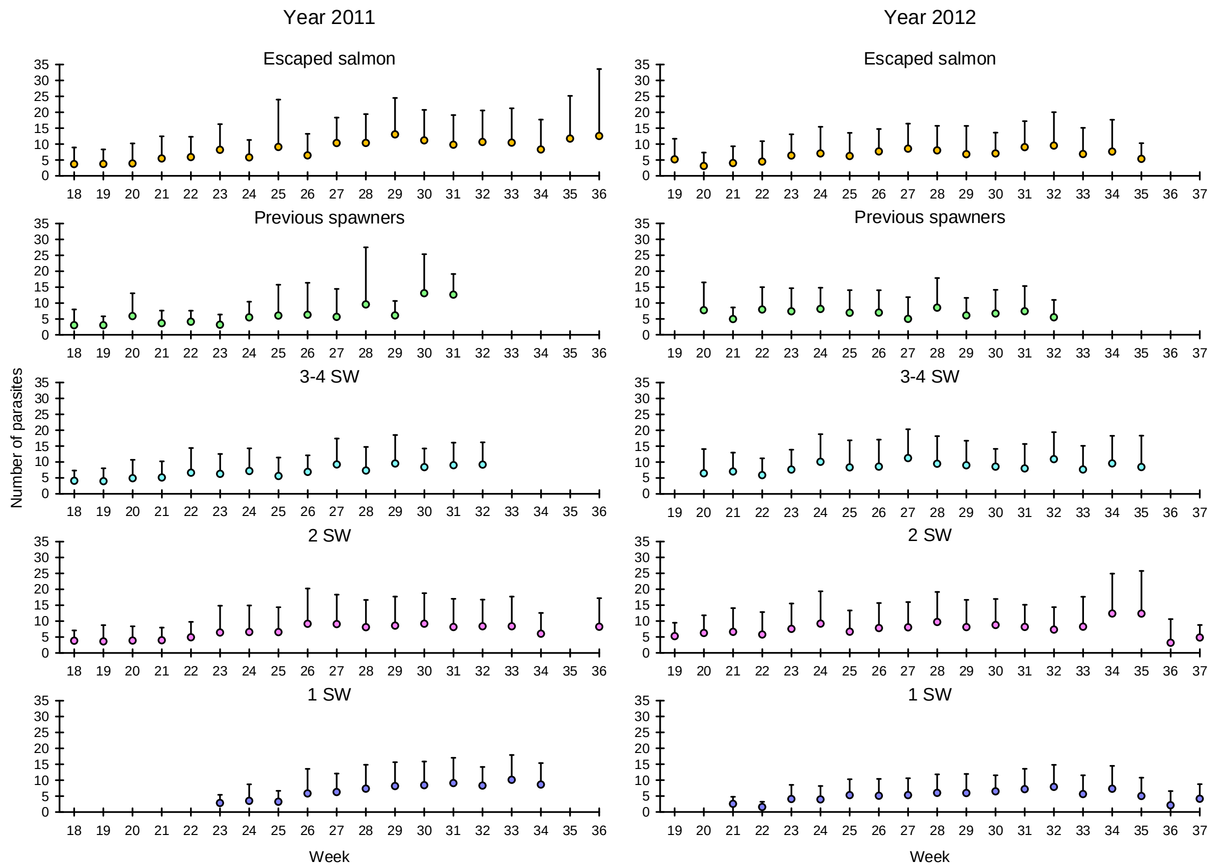



*Figure 44. Mean weekly numbers of salmon lice in wild and escaped salmon in the Kolarctic salmon project area in 2011 and 2012.*

The numbers of salmon lice presented here were counted by professional fishermen when the other sampling and slaughtering work took place. Some lice fell off when fishermen took salmon off of the fishing gear. The abundance of lice increased throughout the summer in most salmon sea ages. Early in the summer in May, the mean numbers of lice were around five in wild and escaped salmon (Figure 44). The highest number of salmon lice in escaped and wild salmon was 99 and 89, respectively. Salmon with the highest numbers of lice were caught mainly in Troms County.

One interesting phenomenon was a previous spawning female salmon with the sea-age of 3S1+ years carrying 74 lice. This indicates that this female fish visited freshwater, stayed there almost one year, and then descended back to seawater. During the post spawning period of almost one year at sea, over 70 lice attached to it. Salmon is migrating as kelt (post spawner) from their rivers of origin after spawning back into the sea. Sometimes these kelts are starting their reconditioning in coastal waters, feeding in fjords or nearby waters many months. During that reconditioning period salmon lice can attach to kelts which might result in increased mortality.

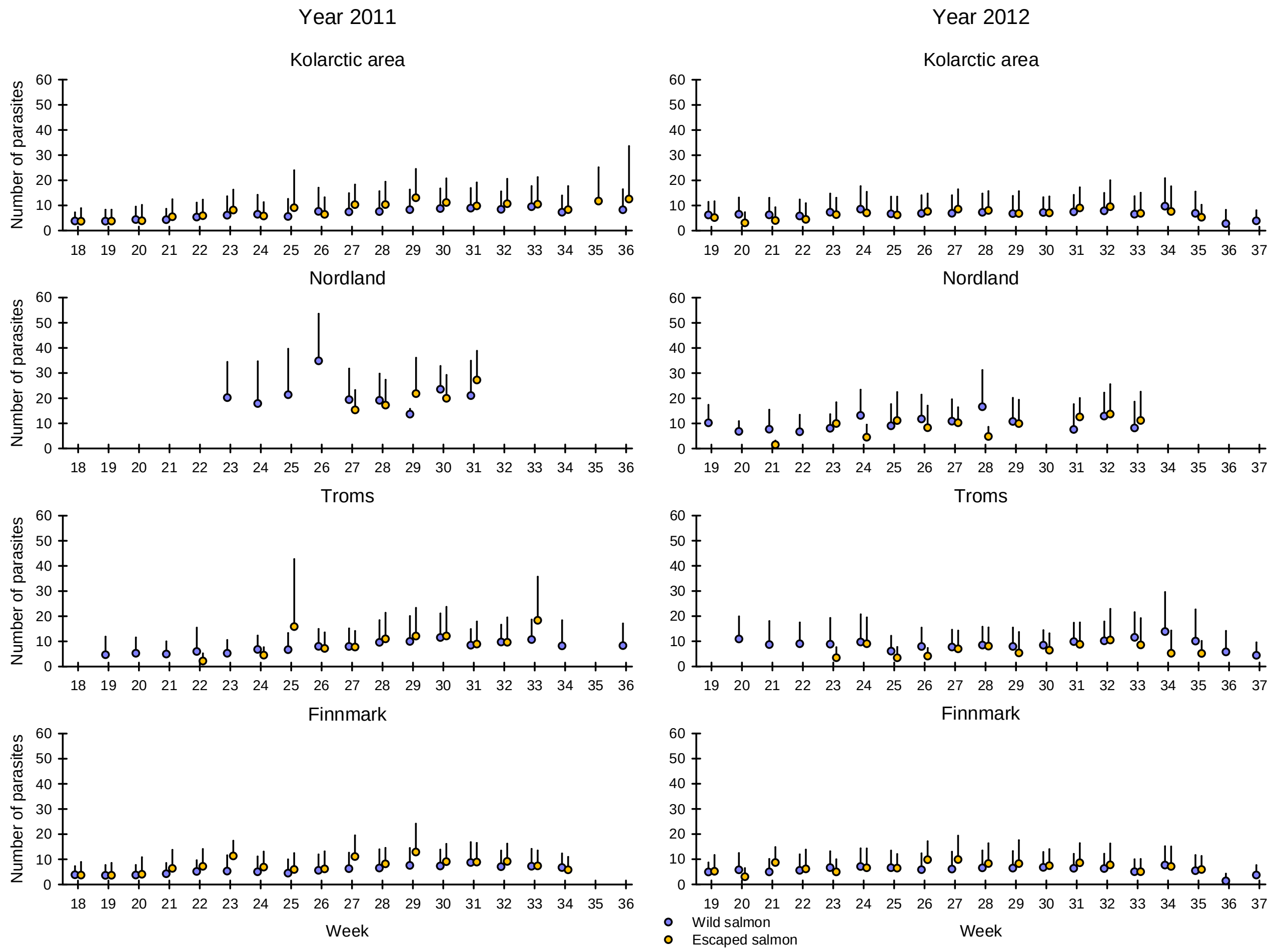



*Figure 45. Weekly mean numbers of salmon lice on wild salmon and escaped salmon.*

Fishermen were asked to count the numbers of salmon lice from all their catches. The mean numbers of lice presented in figure 45 are the minimum values. All the salmon were caught with nets and some lice certainly fell off when fishermen took the salmon off of their nets, although salmon lice are usually strongly attached onto the body of salmon. The weekly mean numbers of lice in wild and escaped salmon were almost the same throughout the summer. The mean numbers of salmon parasites increased in wild and escaped salmon with the increased length of fish in Troms and Finnmark, especially in 2012 (Figure 46). In Nordland the highest mean numbers of parasites were in salmon with the length of 65-70 cm.

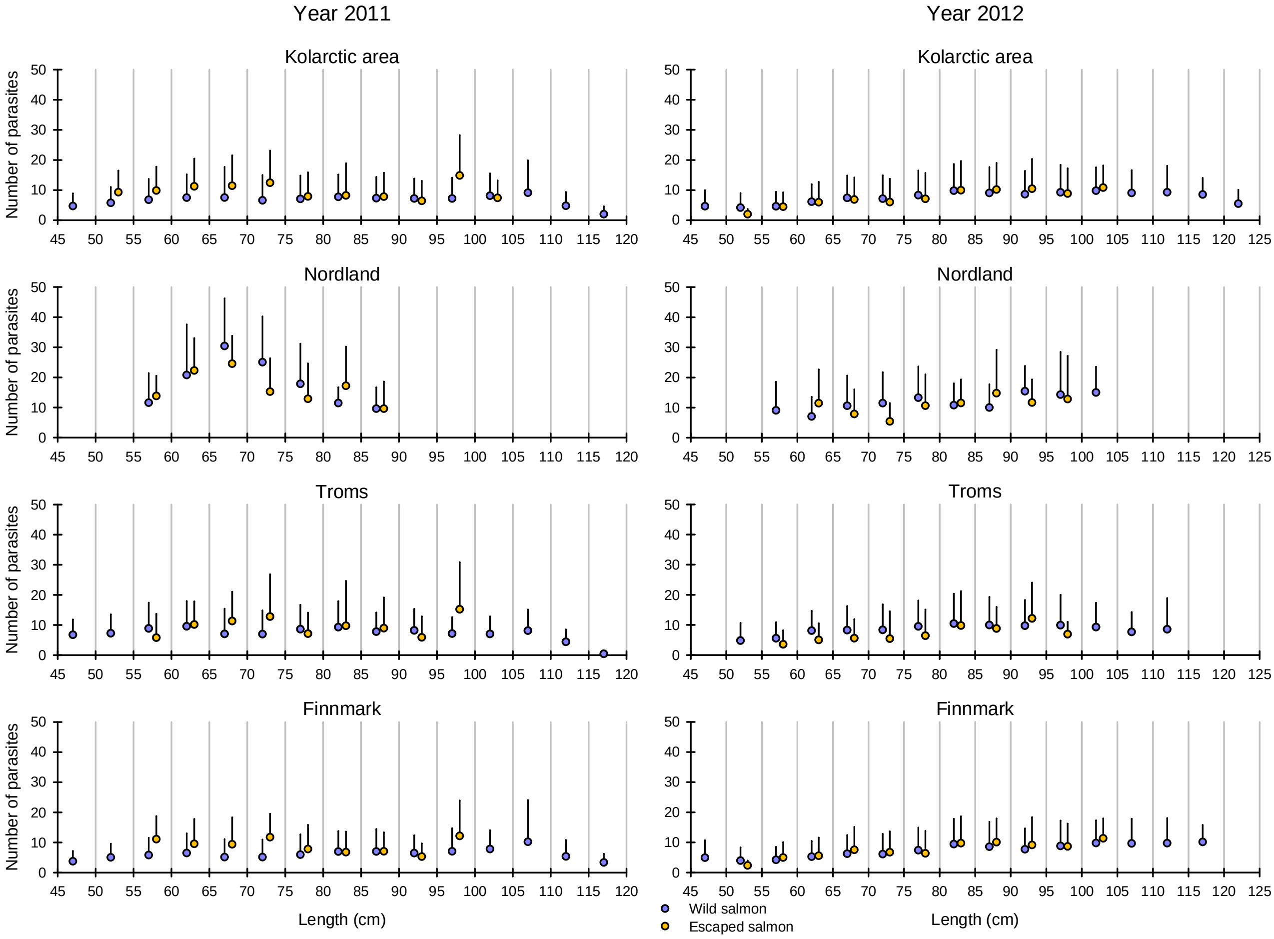



*Figure 46. Mean numbers of salmon lice in different length groups of salmon.*

## *3.7 Escaped salmon in the reported wild salmon catches in Finnmark, Troms and Nordland*

All salmon fishermen at sea have logbooks to report their daily salmon and trout catches. In the logbooks there are columns for the numbers and weights of salmon for the size categories. Those size categories are, divided by weight, less than 3 kilograms, from 3 to 7 kg and over 7 kg. During the official fishing season fishermen are only asked to report the salmon and trout catches. Fishermen include wild salmon as well as escaped salmon into salmon catches, because they are not given the possibility to give separate catch data for wild and escaped salmon. We received daily salmon catch data from Statistics Norway (SSB) divided into the three size categories for each municipality in Finnmark and for North Troms, South Troms and Kolarctic area in Nordland except those municipalities where the number of salmon fishermen was three or less. In those cases we received salmon catch data where two or three municipalities combined. SSB data was in terms of numbers and weights. Official catch information of each week in the years 2011 and 2012 was converted into the estimated numbers and weights of 1SW, 2SW, 3SW, 4SW, previous spawners and escaped salmon using the scale sampling information in each municipality or groups of municipalities. The official catch data is presented on the left in the figures 47-58 and on the right the size categories have been converted to sea-age groups and escaped salmon. Research fishing covered much wider time period from early May to the end of September but here we are concentrating only into the official fishing period. The official fishing season is not the same in all the municipalities. It differs from very short season of two weeks (Nordland) to a longer season of 10 weeks (Nesseby-Vadsø).

## 3.7.1 Nordland

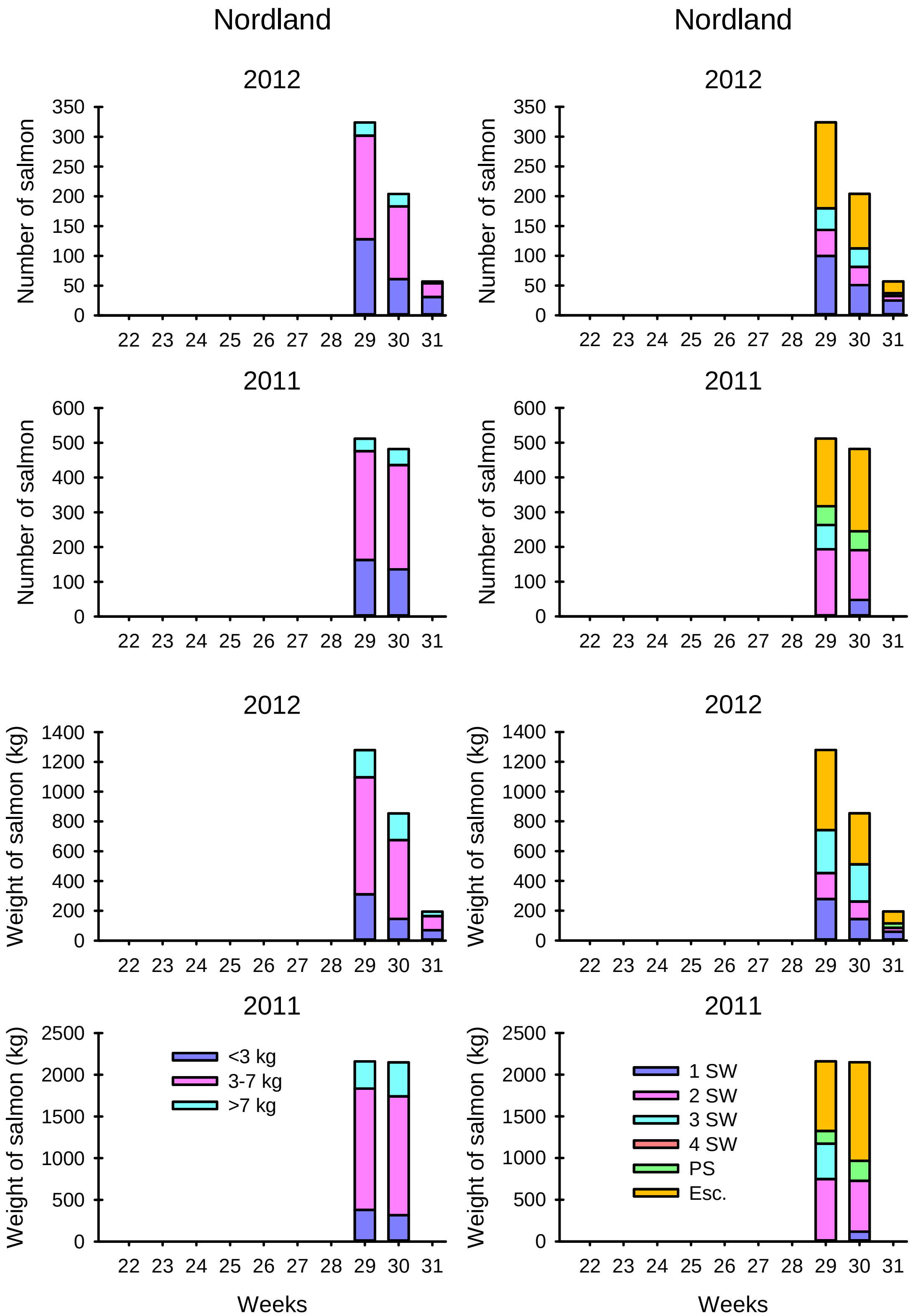



*Figure 47. Statistics Norway (SSB), Nordland catch data and size groups (figure on the left) and official catch data converted into escaped salmon and sea-age groups of wild salmon (figure on the right) for the official fishing time only. Helgeland, Lofoten and Salten include the weeks 29-30 in the year 2011 and in the year 2012 Helgeland and Lofoten include weeks 29-30 and Salten the weeks 29-31.*

### 3.7.2 Southern Troms

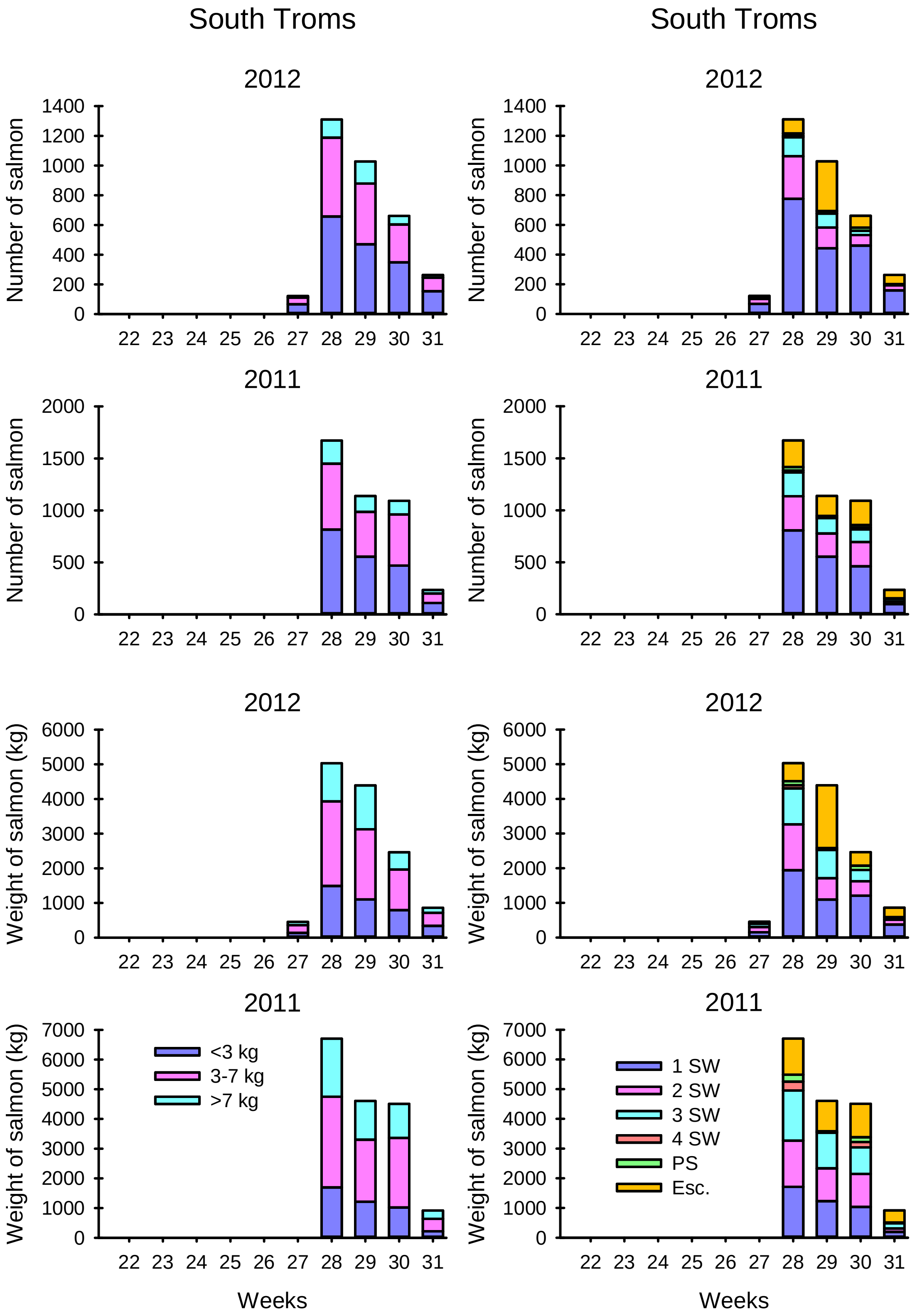



*Figure 48. Statistics Norway (SSB), South Troms catch data and size groups on the left and catch data converted into escaped salmon and sea-age groups of wild salmon on the right for the official fishing time only.*

### 3.7.3 Northern Troms

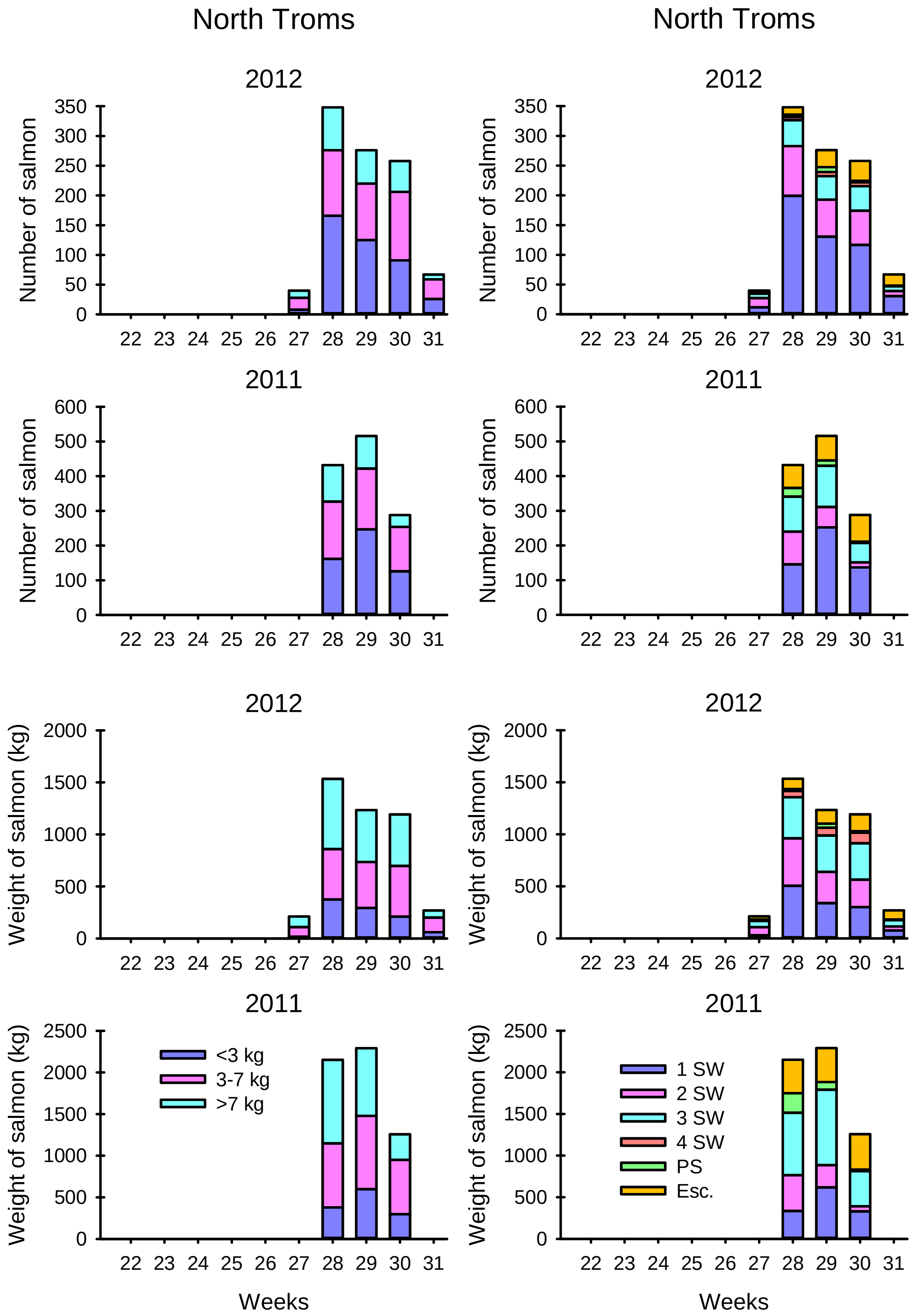



*Figure 49. Statistics Norway (SSB), North Troms catch data and size groups on the left and catch data converted into escaped salmon and sea-age groups of wild salmon on the right for the official fishing time only.*

### 3.7.4 Municipalities Loppa and Hasvik in Finnmark County

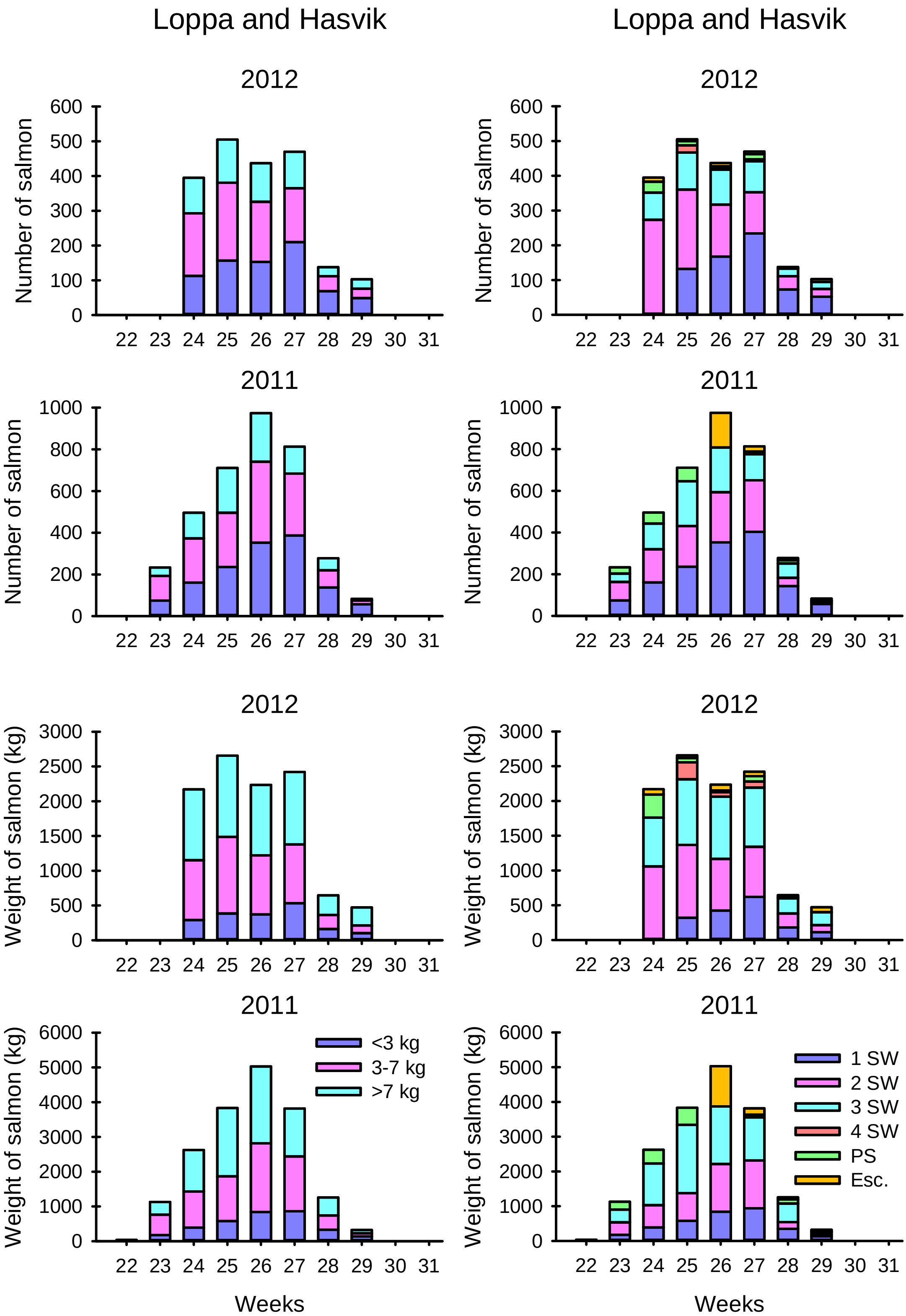



*Figure 50. Statistics Norway (SSB), Loppa and Hasvik catch data and size groups on the left and catch data converted into escaped salmon and sea-age groups of wild salmon on the right for the official fishing time only.*

### 3.7.5 Alta Municipality in Finnmark

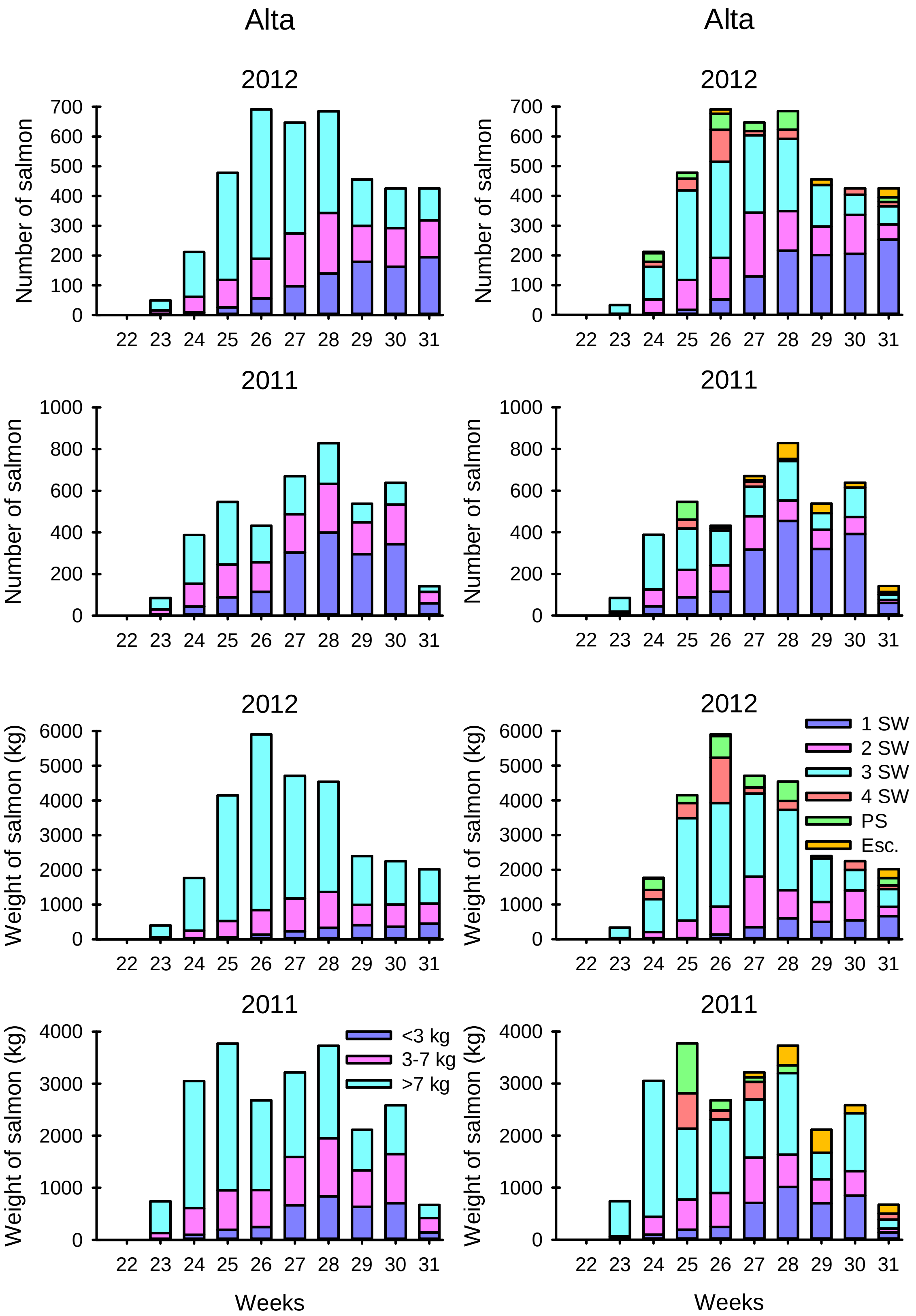



*Figure 51. Statistics Norway (SSB), Alta catch data and size groups on the left and catch data converted into escaped salmon and sea-age groups of wild salmon on the right for the official fishing time only.*

### 3.7.6 Municipalities Nordkapp, Kvalsund, Måsøy and Hammerfest in Finnmark

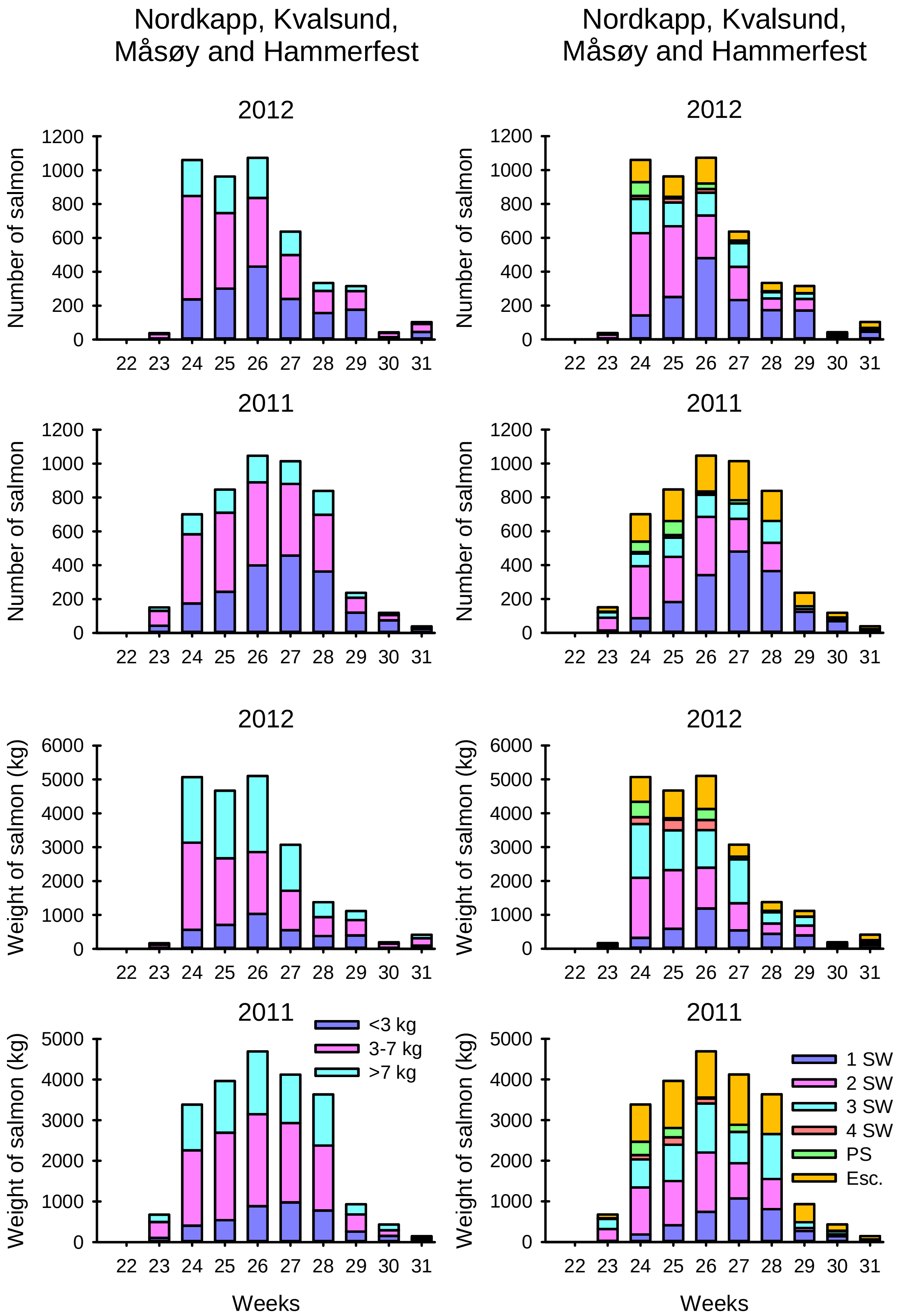



*Figure 52. Statistics Norway (SSB), Nordkapp, Kvalsund, Måsøy, Hammerfest and catch data and size groups on the left and catch data converted into escaped salmon and sea-age groups of wild salmon on the right for the official fishing time only.*

### 3.7.7 Porsanger Municipality in Finnmark

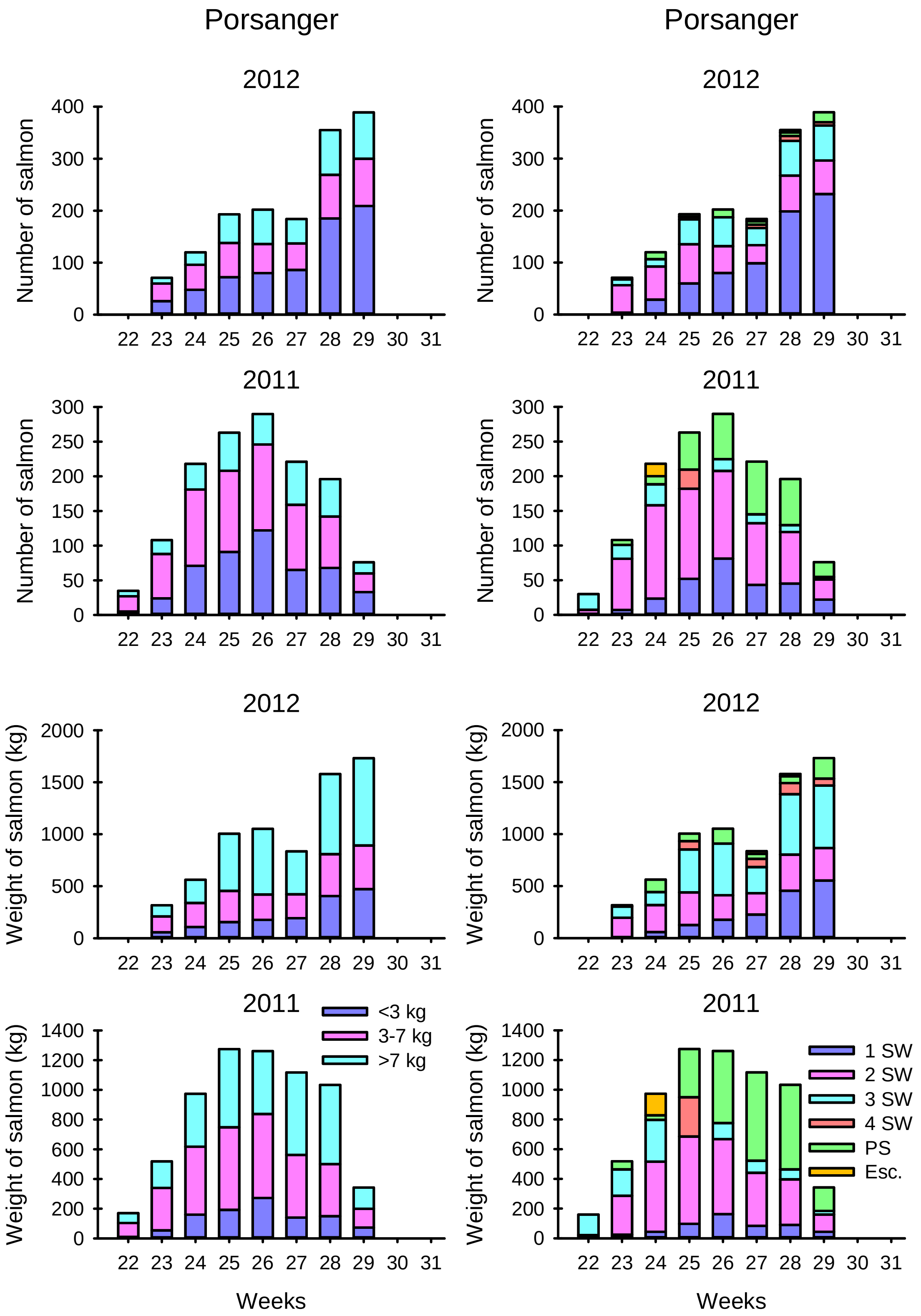



*Figure 53. Statistics Norway (SSB), Porsanger catch data and size groups on the left and catch data converted into escaped salmon and sea-age groups of wild salmon on the right for the official fishing time only.*

### 3.7.8 Lebesby Municipality in Finnnark

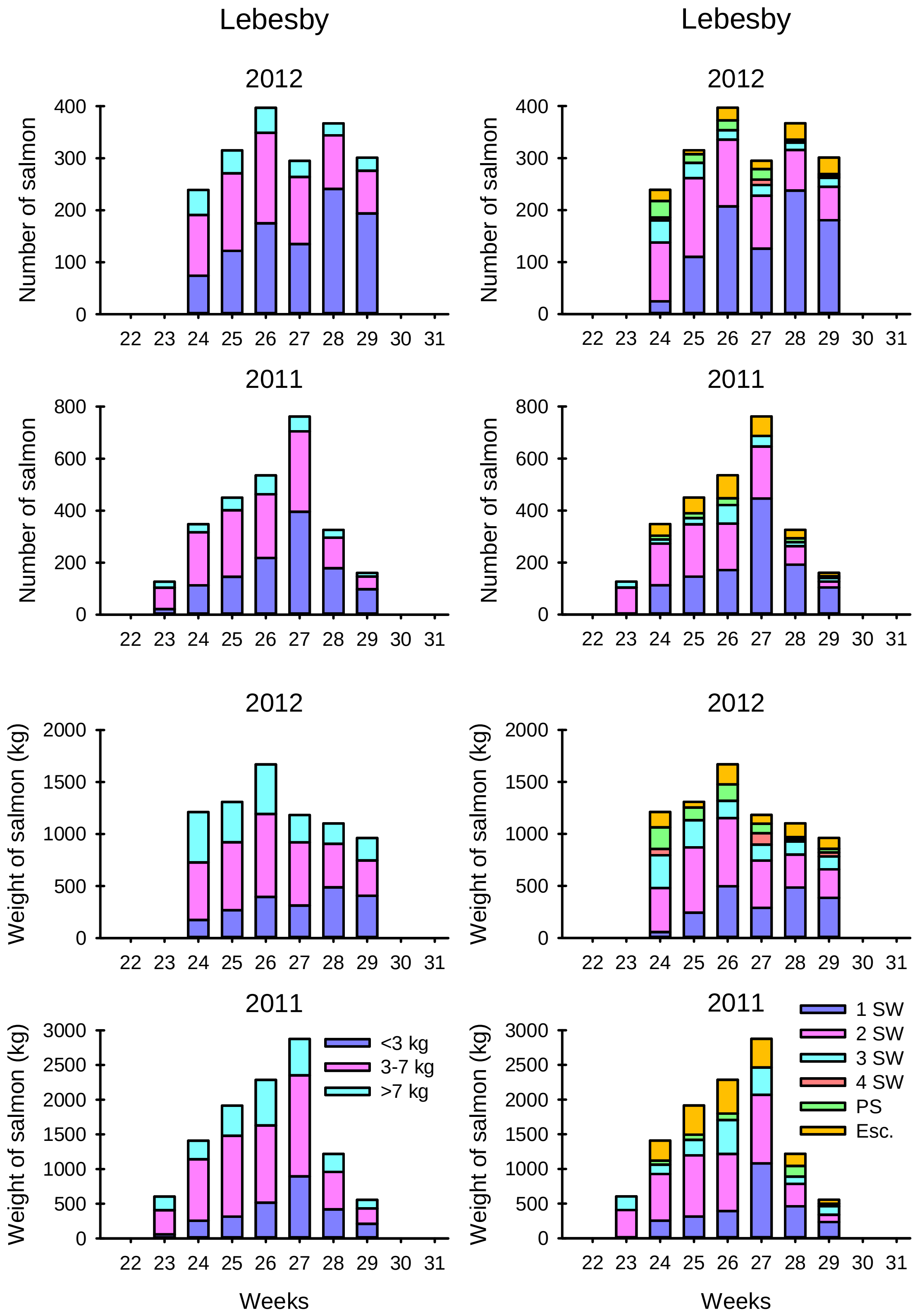



*Figure 54. Statistics Norway (SSB), Lebesby data and size groups on the left and catch data converted into escaped salmon and sea-age groups of wild salmon on the right for the official fishing time only.*

### 3.7.9 Tana Municipality in Finnmark

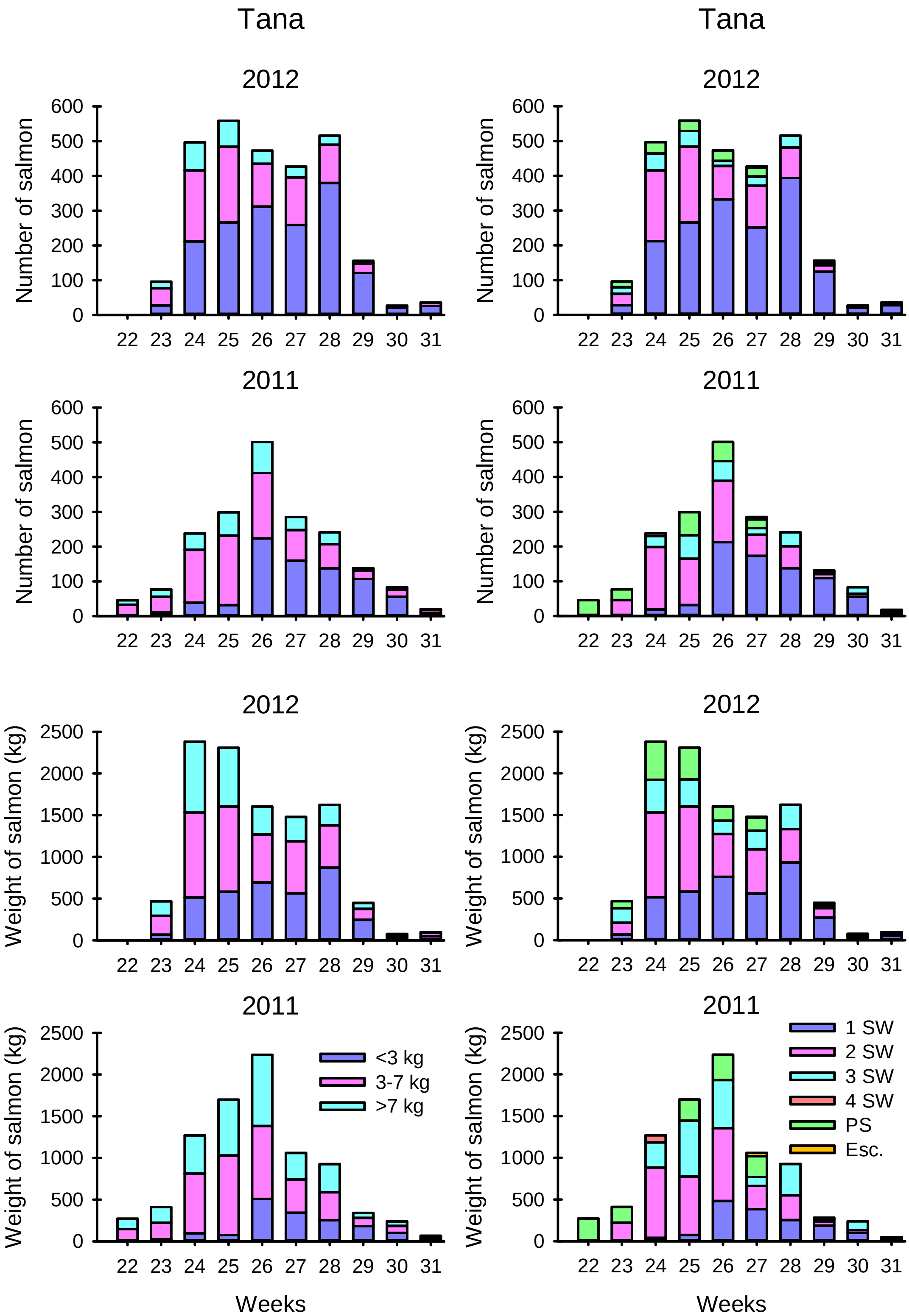



*Figure 55. Statistics Norway (SSB), Tana catch data and size groups on the left and catch data converted into escaped salmon and sea-age groups of wild salmon on the right for the official fishing time only.*

### 3.7.10 Municipalities Gamvik, Berlevåg and Båtsfjord in Finnmark

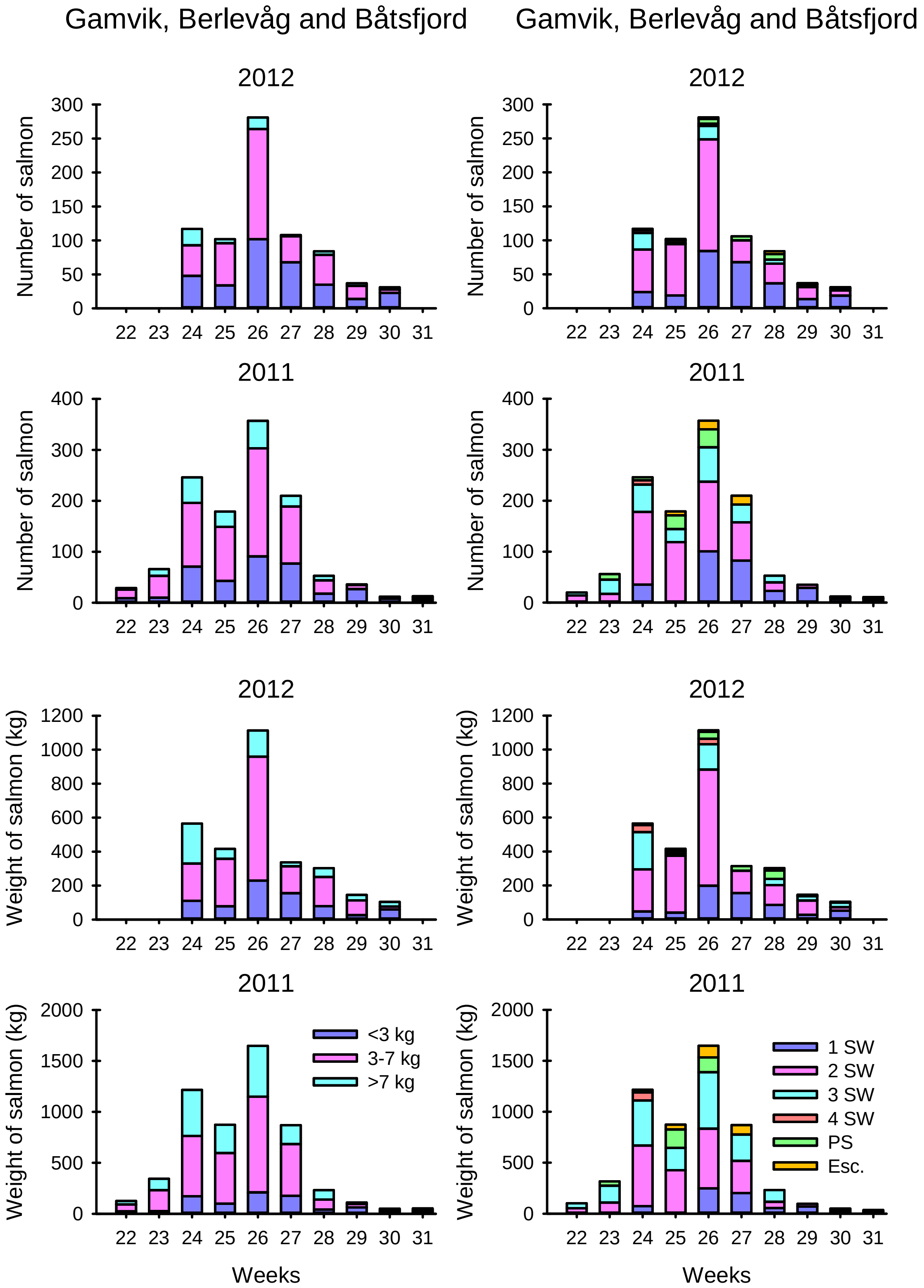



*Figure 56. Statistics Norway (SSB), Gamvik, Berlevåg, Båtsfjord, Vardø catch data and size groups on the left and catch data converted into escaped salmon and sea-age groups of wild salmon on the right for the official fishing time only.*

### 3.7.11 Municipalities Vadsø and Nesseby in Finnmark

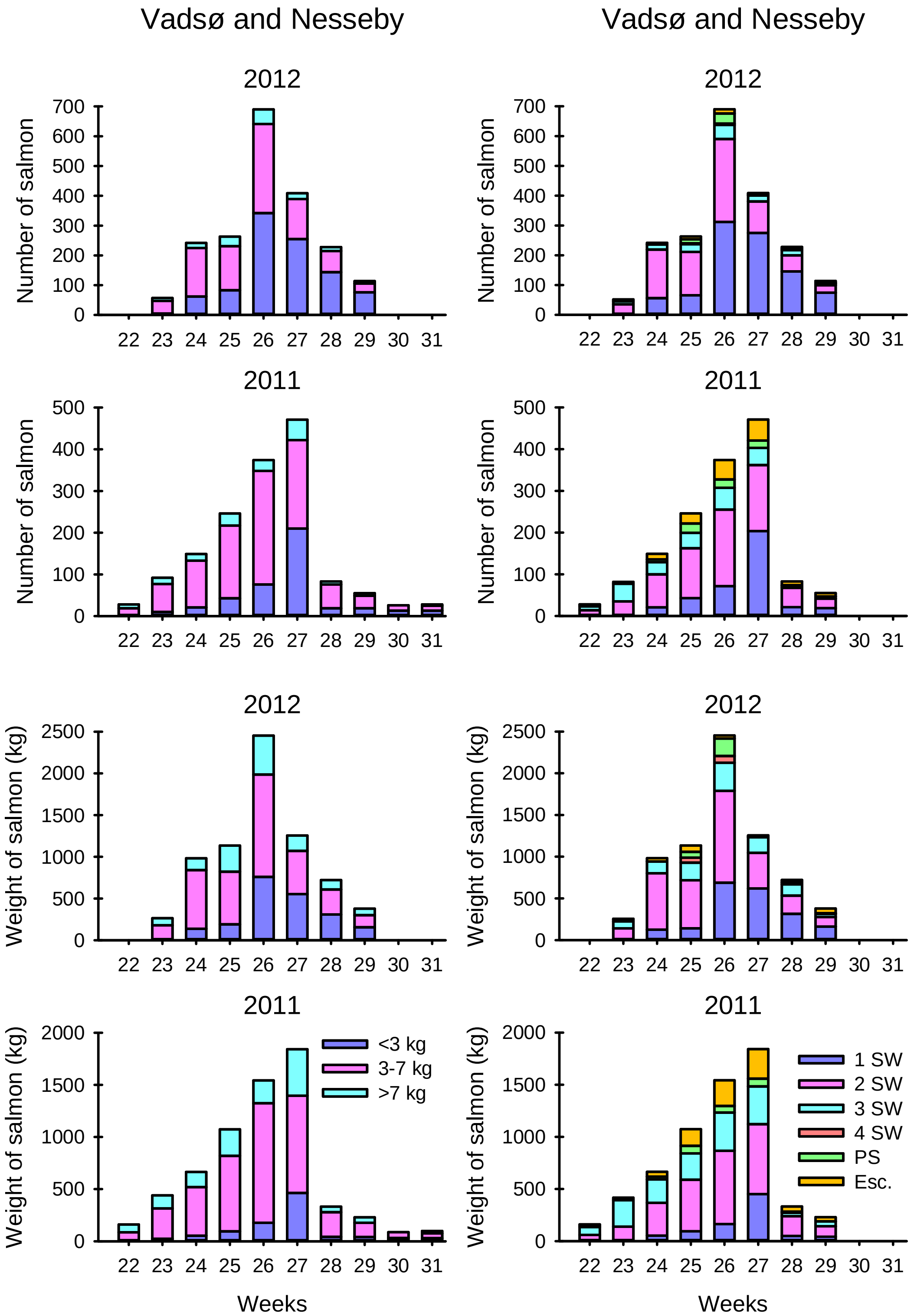



*Figure 57. Statistics Norway (SSB), Nesseby and Vadsø catch data and size groups on the left and catch data converted into escaped salmon and sea-age groups of wild salmon on the right for the official fishing time only.*

### 3.7.12 Sør-Varanger Municipality in Finnmark

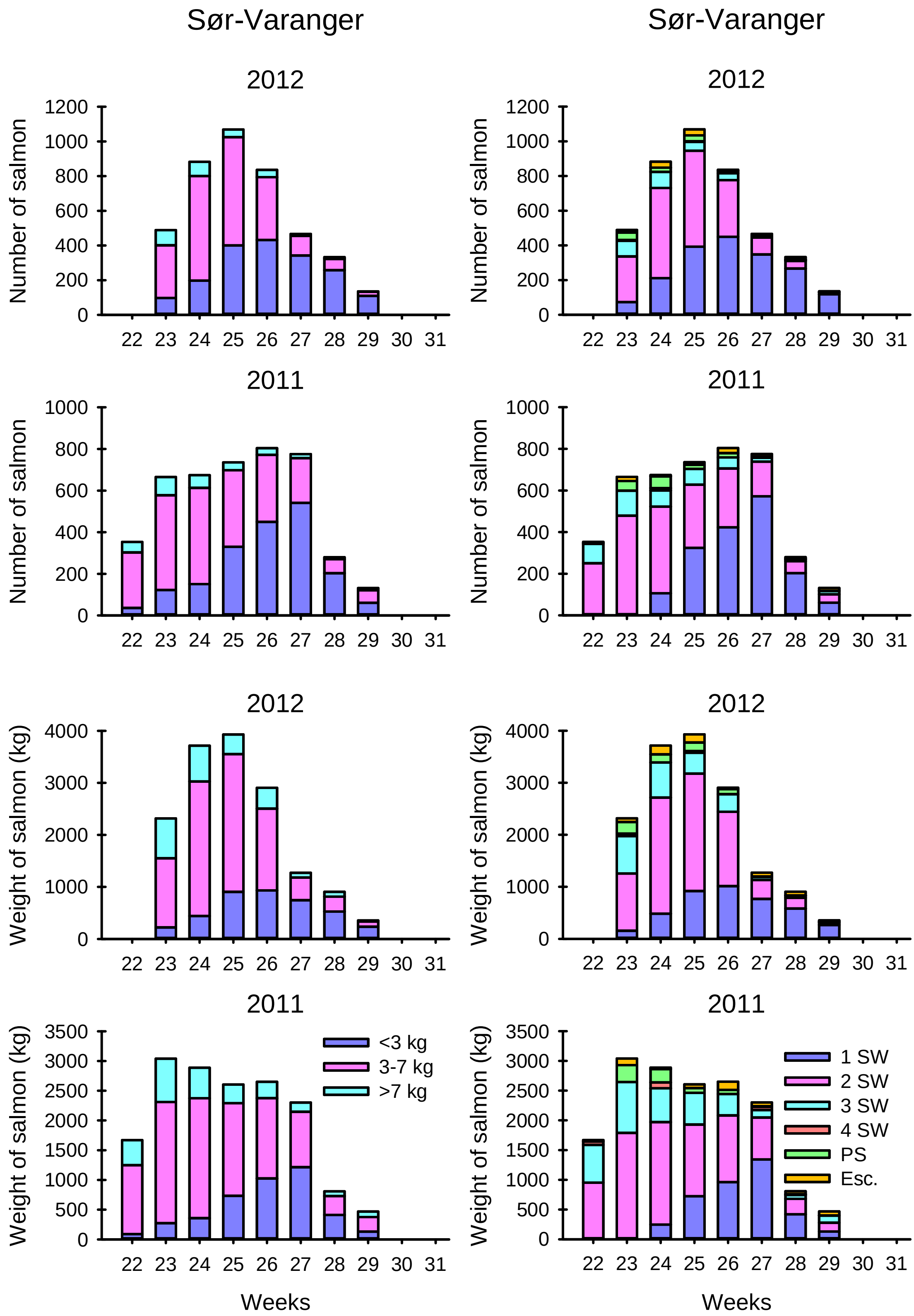



*Figure 58. Statistics Norway (SSB), Sør-Varanger catch data and size groups on the left and catch data converted into escaped salmon and sea-age groups of wild salmon on the right for the official fishing time only.*

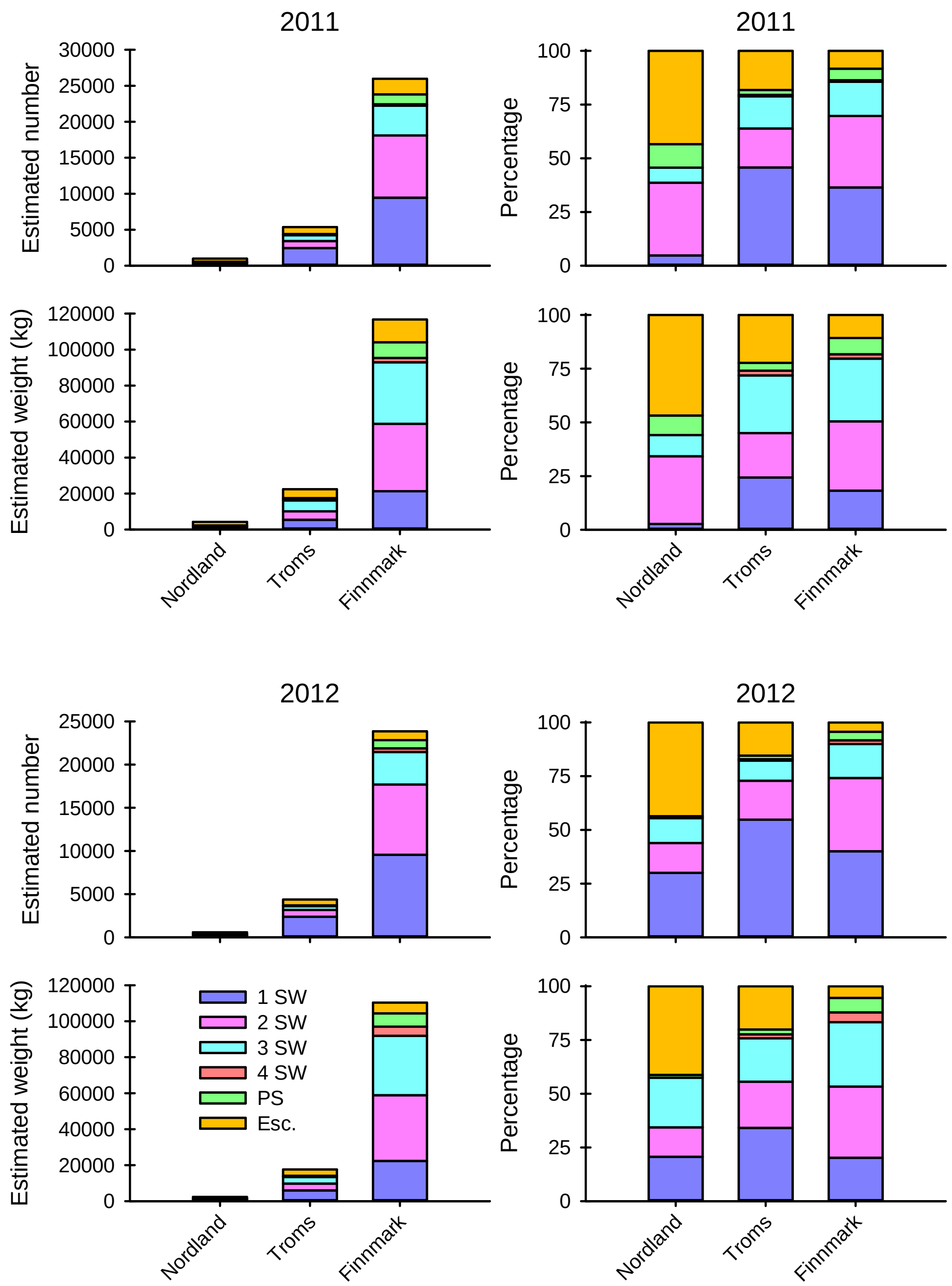



*Figure 59. Numbers and weights of salmon for each sea-age groups and escaped salmon based on the reported salmon catches (SSB) during the official fishing time in Kolarctic area in 2011 and 2012*

In Nordland County there was an extremely high percentage of escaped salmon in the salmon catches in both years (Figure 59). From the officially reported numbers of salmon as much as 44% was escaped salmon and almost half of the catch in terms of weight was escaped salmon. In Troms County 15-18% was escaped salmon in the officially reported numbers of salmon. On the other hand in Finnmark county only about 8 fish out of 100 salmon caught were escaped salmon in 2011 and their occurrence declined in 2012 (Table II).

Table II. Percentages of escaped salmon from the numbers and from the weights of salmon in the reported official salmon catches during the ordinary fishing season in each county. Reported salmon catch is from SSB and it has been converted into sea-age groups.

| | 2011 | | 2012 | |
|---|---|---|---|---|
| | From numbers | From weight | From numbers | From weight |
| **Nordland** | 43 | 47 | 44 | 41 |
| **Troms** | 18 | 22 | 15 | 20 |
| **Finnmark** | 8 | 11 | 4 | 5 |

Figure 60 shows that there are big differences in the proportion of escaped salmon in the catches between municipalities and areas. General trend shows that the proportion of escaped salmon increase towards north (Table III). In national salmon fjords like in Porsangerfjord and Tanafjord the occurrence of escaped salmon has still been low. Surprisingly high proportion of escaped salmon occurred in the outermost coastal areas in Nordkapp, Hammerfest, Måsöy and Kvalsund area and also in Laksefjord (Lebesby). The table III resents percentage of escaped salmon in each municipality during the official fishing time.

*Photo 44. The tail fin of an escaped salmon with broken rays*

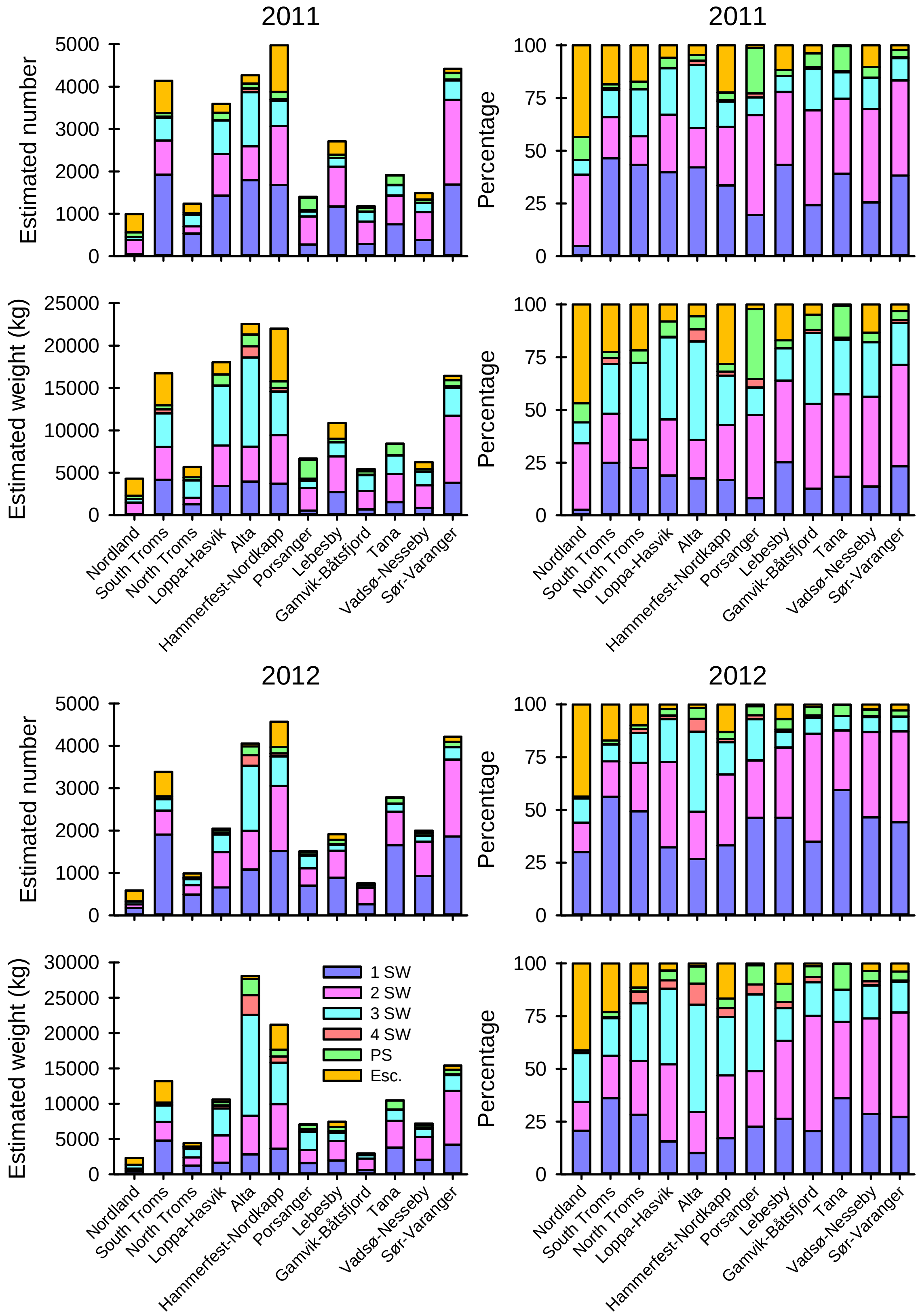



*Figure 60. Numbers and weights of salmon within sea-age groups and escaped salmon in the reported catches (SSB) during the official fishing time in Kolarctic salmon project area in 2011 and 2012*


*Photo 45. Leif Ingilæ fishing salmon in Eastern Finnmark, Bygøynes.*

Table III. Percentages of escaped salmon from the numbers and from the weight of salmon in the reported official salmon catches during the ordinary fishing season in each municipality or in the groups of municipalities. Reported salmon catch is from SSB and it has been converted into sea-age groups. Nordkapp area includes Måsøy, Kvalsund and Hammerfest; Gamvik and Båtsfjord includes Berlevåg and Vardø

| | Year 2011 | | Year 2012 | |
|---|---|---|---|---|
| | From numbers | From weight | From numbers | From weight |
| Nordland | 43 | 47 | 44 | 41 |
| South-Troms | 18 | 23 | 17 | 23 |
| North-Troms | 17 | 22 | 10 | 11 |
| Loppa/Hasvik | 6 | 8 | 2 | 3 |
| Alta | 5 | 6 | 2 | 1 |
| Nordkapp | 22 | 28 | 13 | 17 |
| Porsanger | <1 | 2 | <1 | <1 |
| Lebesby | 12 | 17 | 7 | 10 |
| Gamvik/Båtsfjord | 4 | 5 | <1 | <1 |
| Tana | <1 | <1 | <1 | <1 |
| Vadsø/Nesseby | 10 | 13 | 2 | 4 |
| Sør-Varanger | 2 | 3 | 3 | 4 |

## Acknowledgements

This study was funded by the European Union, Kolarctic ENPI CBC project – *Trilateral cooperation on our common resource; the Atlantic salmon in the Barents region* - "Kolarctic salmon" (KO197) and national sources in each participating country. The Lead partner of the project is the Office of the Finnmark County Governor (FMFI). Partners in Finland: University of Turku (UTU) and Finnish Game and Fisheries Research Institute (FGFRI). Partners in Norway: Institute of Marine Research (IMR) and Norwegian Institute of Nature Research (NINA). Partner in Russia: Knipovich Polar Research Institute of Marine Fisheries and Oceanography (PINRO).

Responsibilities in this report: FGFRI conducted the work concerning the salmon scales collected in Nordland, Troms and Finnmark: establishing the basic scale information file, making impressions from the scales, ageing salmon, designing and producing the graphs and writing the text. FMFI organised together with FGFRI the scale collection and sampling arrangements including: information to fishermen, scale sampling manual drafting, design and purchase of scale bags, handling incoming samples and payments to fishermen.

NINA applied for the special research permission from the Norwegian Directorate of Nature Management for fishing outside the ordinary fishing season and had contact with fishermen in Nordland and Troms.

The Sea salmon fishers associations in Finnmark and Troms gave valuable input and contacted potential fishermen, who collected the research material.

The Lead Partner and partners of the Kolarctic ENPI EU salmon project KO197 warmly thank all the fishermen for their cooperation during the sampling period. Without the help of professional fishermen we could not have collected the marvellous biological material from the salmon catches in this project area. We are thankful also to the sea salmon fishing organizations in Finnmark and Troms. We also want to say thanks to all the people who helped us process the salmon scale material.

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