



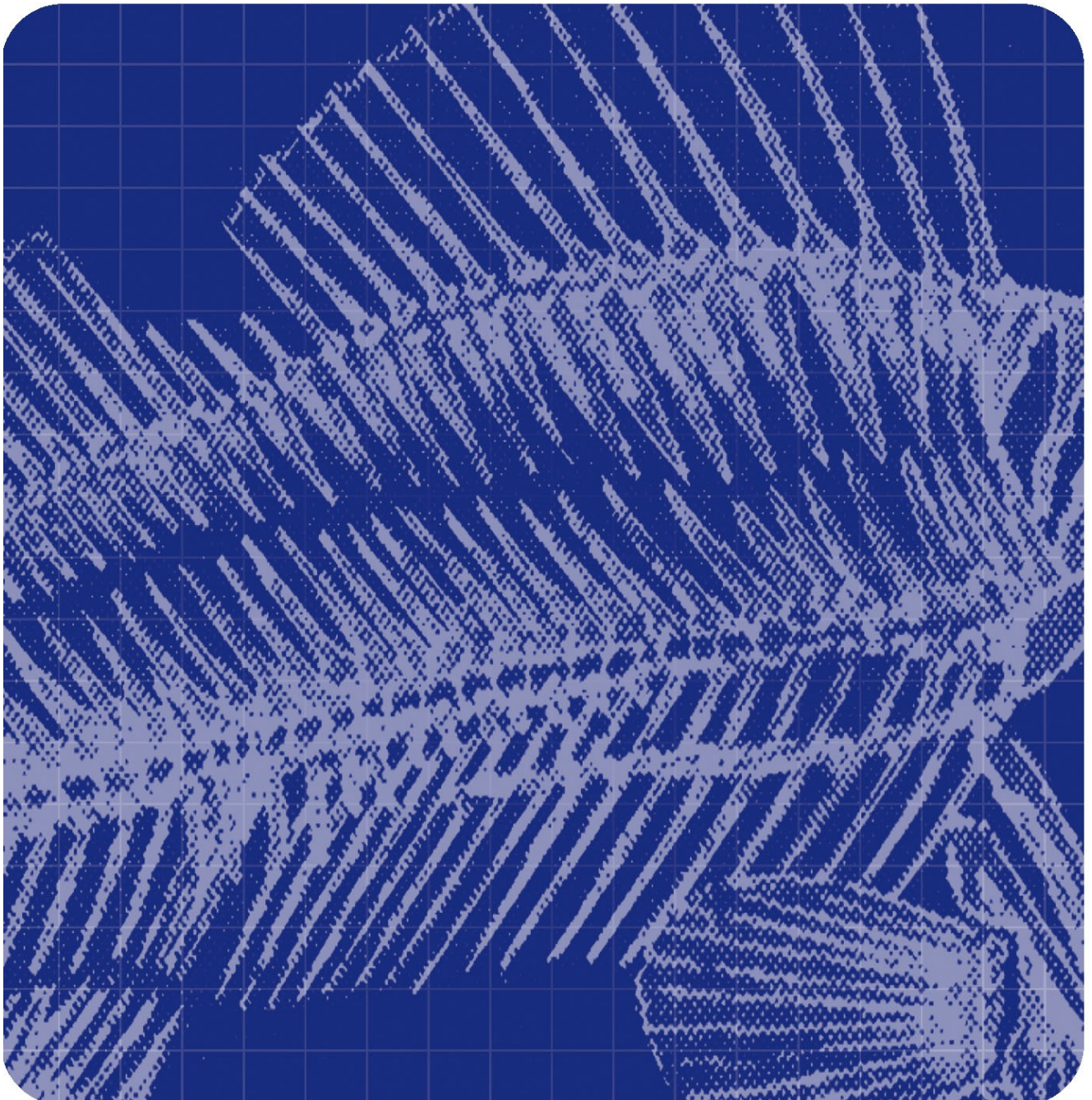
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Norwegian Trout in Japan

Consumer preferences, perceptions and competitors

Roger Richardsen and Jens Østli





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Tromsø (head office)
Muninbakken 9-13, Breivika
P.O.box 6122
NO-9291 Tromsø
Norway
Tel.: +47 77 62 90 00
Fax: +47 77 62 91 00
E-mail: post@fiskeriforskning.no

Bergen
Kjerreidviken 16
NO-5141 Fyllingsdalen
Norway
Tel.: +47 55 50 12 00
Fax: +47 55 50 12 99
E-mail: office@fiskeriforskning.no

Internet: www.fiskeriforskning.no

REPORT

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<i>Summary:</i> <p>Consumer preferences on 7 product products of salmon and trout were evaluated using blind tests in 2 (two) different product categories: Smoked and Sashimi. This preference test was conducted as a Central Location Test in Tokyo and Osaka. 240 married women were recruited as participants evenly distributed in age groups between 30 to 60 years of age. Product testing was also done by a Japanese expert sensory panel.</p> <p>In the product category of smoked, Japanese consumers ranked the Norwegian trout as the best! Smoked products based on frozen Norwegian trout were ranked on top, followed by smoked from fresh Norwegian trout. Frozen Atlantic salmon, both of Norwegian and Chilean origin, together with frozen Chilean trout were evaluated as the second best group. The poorest ranking in the smoked category was given to products made from fresh Tasmanian salmon and fresh Atlantic salmon.</p> <p>The Norwegian trout scored high on good (natural) red colour, firm texture of the flesh, distinct fishy flavour, a high fat content, including good (fat) marbling, i.e. white stripes in the meat.</p> <p>Rather surprisingly, Norwegian trout for use as <i>sashimi</i> also achieved a good score with the consumers. From what we could expect, fresh Norwegian salmon and fresh Tasmanian salmon were also evaluated well by the consumers. Tasmanian salmon in particular scored much better for use as sashimi than as a smoked product. Conversely, we see that frozen Chilean salmon came out significantly <u>poorer</u> than the six remaining products tested.</p> <p>Preference Mapping indicates that a high fat content, “oily” aftertaste, “sweetness”, “melting texture”/elastic texture, and distinct/visible white stripes (marbling) “can explain” why some products were evaluated more attractive than others.</p>			

PREFACE

This project has been carried out on behalf of and in co-operation with the Norwegian Seafood Export Council. Department of Economics and Marketing at the Norwegian Institute of Fisheries and Aquaculture Research has been responsible for the scientific planning and implementation.

The project has been carried out by the following persons:

Roger Richardsen, Director of Research,	Project Leader
Pirjo Honkanen, Scientist,	Data Analysis
Jens Østli, Scientist,	Project Design and Planning
Dr. Hal MacFie, Sensory Dimensions, Bristol, UK	Project Design and Data Analysis

In addition, the following firms have been involved as subcontractors in conducting consumer surveys and sensory evaluations of products in Japan:

SMIS & Co. Ltd, Tokyo, Japan	Recruitment for and conducting of consumer survey in Tokyo and Osaka.
Tetsuo Aishima, Chemsensmetrix, Tokyo	Sensory evaluations at Kikkoman Sensory Laboratory)
Peter Moore, Sensory Dimensions, UK	Training of Japanese interview personnel for Rep Grid Interview methodology
Export Delegate Mika Tomiyama:	Contact and organisation for Japanese subcontractors
Export Delegate Ola Brattvoll:	Contact and organisation for Japanese subcontractors

Production of samples for the consumer trials was made by a Japanese processor in Tokyo area from raw material available through commercial channels in the market.

The project was carried out on commission from the Analysis Department at the Norwegian Seafood Export Council, where the following persons have been participating as a Project group: Paul Aandahl, Egil Sundheim, and Jan Trollvik.

We would like to thank the Norwegian Research Council, the Research Fund of Fisheries and Aquaculture (FHF) and Norwegian Seafood Export Council for the funding of the project.

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1 SUMMARY

Export of Norwegian trout to the Japanese market has increased substantially throughout the last decade. The popularity of this salmon specie has been based on the fact that the product has found its way into countless numbers of Japanese dishes. To further stimulate this development it is vital to study consumer perceptions to be able to focus the marketing of the positive quality attributes of the Norwegian trout. Until recently the trout has been little known on its own terms. Therefore, a vital point for further development is to generate a deeper understanding of the market including substitutes. Of particular interest is to understand which sensory attributes are important on the consumer level.

Consumer preferences on 7 products of salmon and trout were evaluated as blind tests in 2 (two) different product categories: “**Smoked**” and “**Sashimi**”. The consumers evaluated four different product attributes in each individual product, in addition to a total evaluation of to what degree they liked it or not. The preference test was conducted as a Central Location Test in Tokyo and Osaka. For the evaluation, 240 married women were recruited evenly distributed in the age groups between 30 to 60 years of age.

Product testing was also done by a Japanese expert sensory panel.

Product samples to be tested were purchased from normal commercial sources in Tokyo, processed the same way by a well-known Japanese seafood company, and packed in neutral packages before presentation to consumers.

Smoked products

In the product category of *smoked*, Japanese consumers ranked the Norwegian trout as the best! Smoked products based on frozen Norwegian trout were ranked on top, followed by smoked from fresh Norwegian trout. Frozen Atlantic salmon, both of Norwegian and Chilean origin, together with frozen Chilean trout were evaluated as a the second best group. The poorest ranking in the smoked category was given to products made from fresh Tasmanian salmon and fresh Atlantic salmon.

The fish meat colour is a very important attribute for the consumers, not least when we are talking about salmon products. From European studies we know that the customers use the red colour as an indicator of quality. And good red colour liking, of both fresh and frozen Norwegian trout is an important factor explaining the consumer preference. Measured as red colour intensity, both consumers and results from the expert sensory panel showed that Norwegian and Chilean trout were considered to have equal red colour (and better than the other products tested). A conclusion on the results for colour is thus that for the consumers, it is possibly not correct that “the redder, the better”. The colour in the product must also be perceived as “natural”, not “artificial” in depth or intensity. In this context, the Norwegian trout scored very high.

In total, the Norwegian trout scored high on good (natural) red colour, firm texture of the flesh, distinct fishy flavour and a high fat content, including good (fat) marbling, i.e. distinctive white stripes in the meat.

Perceptual mapping analysis in the smoked category also indicates a small potential segment of consumers preferring another type of smoked product, i.e. a product with less distinct fishy flavour, more firm and sweeter compared to the bulk of the consumers.

Sashimi products

Rather surprisingly, Norwegian trout for use in *sashimi* also achieved high scores in the preference tests. From what we could expect, fresh Norwegian salmon and fresh Tasmanian salmon were also evaluated favourably by the consumers. Tasmanian salmon in particular scored much better for use as sashimi than as a smoked product. Conversely, we see that frozen Chilean salmon were evaluated significantly poorer than the six other products tested. A similar ranking order was established when it comes to the specific quality attributes: Flavour, texture, fat content and colour.

For *sashimi*, the intensity of the red colour in Chilean trout was evaluated better (higher) than in any of the other products, cf. discussion of the same theme for smoked products. Also the expert panel evaluated the Chilean trout as having slightly deeper intensity of red colour. In spite of this, the Norwegian trout scored better with the consumers concerning satisfaction/attractiveness with the colour.

Preference Mapping indicated that a high fat content, “oily” aftertaste, “sweetness”, “melting texture”/elastic texture, and distinct/visible white “fat” stripes were favourable product attributes.

The study presented in this report aimed at trying to map preferences and perceptions of salmonoid products in the categories smoked and sashimi in the Japanese market. The study confirms what was anticipated and known about the same market, which definitely strengthens the validity of the results. In a very convincing way it is documented why Japanese importers have embraced the Norwegian trout. The colour, the fat content and the taste seem to fit the Japanese palate very well.

The fact that frozen Norwegian trout was (one of) the most preferred product in the smoked category, raises very interesting industrial and commercial perspectives.

The smoked salmonoid product category is fairly new in the Japanese market, a category which needs further development to grow. The results point at the Norwegian frozen trout being a very attractive candidate to boost this development. Besides frozen commands cheaper logistic solutions and offers a more predictable supply situation.

For the sashimi category, the results also document that the three Norwegian “participants”: Fresh and frozen trout and fresh salmon plus Tasmanian fresh salmon were the most preferred.

2 INTRODUCTION

Export of Norwegian trout has increased substantially throughout the last decade. The popularity of this salmon specie has been based on the fact that the product has found application in a varying number of Japanese dishes. Trout is sold mainly as fillet cuts [kirimimi] in competition with Sockeye and Coho salmon, as fresh/raw fish [sushi and sashimi] in competition with farmed Atlantic salmon, and finally as smoked fillet in competition with Atlantic salmon and Coho.

Previous studies of the major players in the distribution channels for salmon indicate that most distributors mainly use the price criteria when choosing between close substitutes. They do that in belief and conviction that the consumers do not know or perceive quality differences between species. At the same time trout is known to have good (appealing/attractive) red colour and fat content, preferred attributes by the Japanese consumers.

Looking at the long term trends in Japanese salmon consumption, it seems clear that there is a shift from leaner wild (Pacific) salmon to farm raised salmon with a higher fat content. To stimulate this trend further it is vital to study consumer perceptions in the market to be able to communicate the positive quality attributes of the Norwegian trout. Up to now the trout has been little known on its own terms. In Japanese, the name of sea farmed rainbow trout indicates the same product as portion size trout raised in fresh water ponds. A vital point for further development is therefore to generate a deeper understanding of the market including substitutes. Of particular interest is to understand which sensory attributes are important on the consumer level.

By testing real products at the consumer level we wanted to focus on the following research topics:

1. Does the Japanese consumer perceive quality differences of trout vs. other salmon species?
2. What salmon species are liked the best?
3. Which sensory attributes are driving consumer preferences?
4. Are there any segments among consumers based on preferences?

3 RESEARCH DESIGN

In Part 1 of the consumer survey, blind tests were conducted on seven product samples of salmon and trout in two different product categories, “**Smoked**” and “**Sashimi**”. The consumers tasted and evaluated four different product attributes in each individual product, in addition to a total evaluation of to what degree they liked it or not. This preference test was conducted as a Central Location Test in Tokyo and Osaka. For the evaluation, 240 married women were recruited evenly distributed in the age groups between 30 to 60 years of age. These women do all of the regular shopping for their families, and had previous experience from consumption of both product groups.

A minor “country-of-origin” study using labelled and unlabelled packages was also included.

Table 1. Demographic frequencies of respondents.

Type of Work	city			Household size	city		
	Tokyo N	Osaka N	All N		Tokyo N	Osaka N	All N
Civil worker	2	.	2	2	5	9	14
Corporate employee	38	37	75	3	16	10	26
Corporate executive	10	5	15	4	30	22	52
Self-employed	8	13	21	5	8	15	23
Freelancer	.	3	3	6	2	4	6
Public Org worker	2	.	2	7	.	2	2
Teacher	1	1	2	8	.	1	1
Unemployed	.	2	2				
Other	.	2	2				
total	61	63	124				
				total	61	63	124

In Part 2 a Japanese expert panel tested the same 14 products, i.e. specialists in sensory evaluation of food products. In this case, we used a sensory panel at Kikkoman Co., Tokyo.

In Part 3, a “Repertory Grid” Analysis was conducted using a panel of 50 consumers (different from the participants in Part 1). These consumers visually evaluated and described the 14 products using their own words. The objective was to improve the understanding of the consumers’ perceptions and use of concepts for different product attributes. This is compared with the results from the expert panel. This method produces a lexicon for consistent concepts to describe quality attributes of smoked and “Sashimi” salmonid products– and which can be used in the marketing of salmon and trout products.

4 SMOKED PRODUCTS

The testing of consumer preferences was done as a Central Locations Test in two product categories, namely as *smoked* product and as *sashimi*. In the following we first present the main results from the testing of *smoked* products. In chapter 5 we present the results for the sashimi products.

4.1 Consumer preferences for smoked products

In the product category “Smoked products”, Norwegian trout, both fresh and frozen, was mostly preferred among the 240 consumers. The very best of all was frozen Norwegian trout, cf. Figure 1. Frozen Atlantic salmon, both Norwegian and Chilean, together with frozen Chilean trout, came second best. The least liked products were fresh Tasmanian salmon and fresh Atlantic salmon from Norway. As a basis for their total evaluation (overall liking), the consumers judged the products according to the following product attributes: Flavour, texture, fat content, and colour. Differences in the “Overall liking” indicate which factors the consumers emphasised in the evaluation of the products.

The results presented in the figures are all the mean scores given by the 240 consumers. Due to various reasons there will always be variations in the evaluations of the attributes. The line running vertically through each bar is a measure for this variation. The longer the line the stronger the disagreement among the consumers. The differences between the products are statistically significant in those cases where these lines are not overlapping. In Figure 1 there is a significant difference between smoked Norwegian fresh and frozen trout and smoked fresh Atlantic (Norwegian) salmon, while there is no significant difference between smoked products of fresh Norwegian trout and frozen Atlantic (Norwegian) salmon.

In the preference tests, the products were evaluated according to a 9-point Likert Scale from 1 = Dislike extremely to 9 = Like extremely.

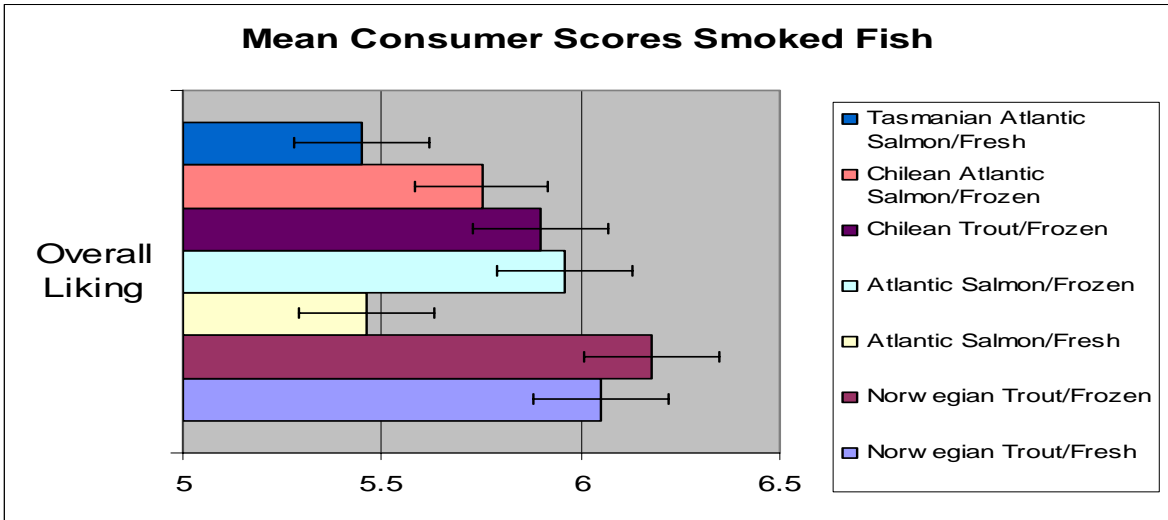


Figure 1. Mean score on total satisfaction of smoked products.

That products based on frozen Norwegian trout scored best of all provides very interesting industrial perspectives and documents the strong position this product enjoys in the Japanese market.

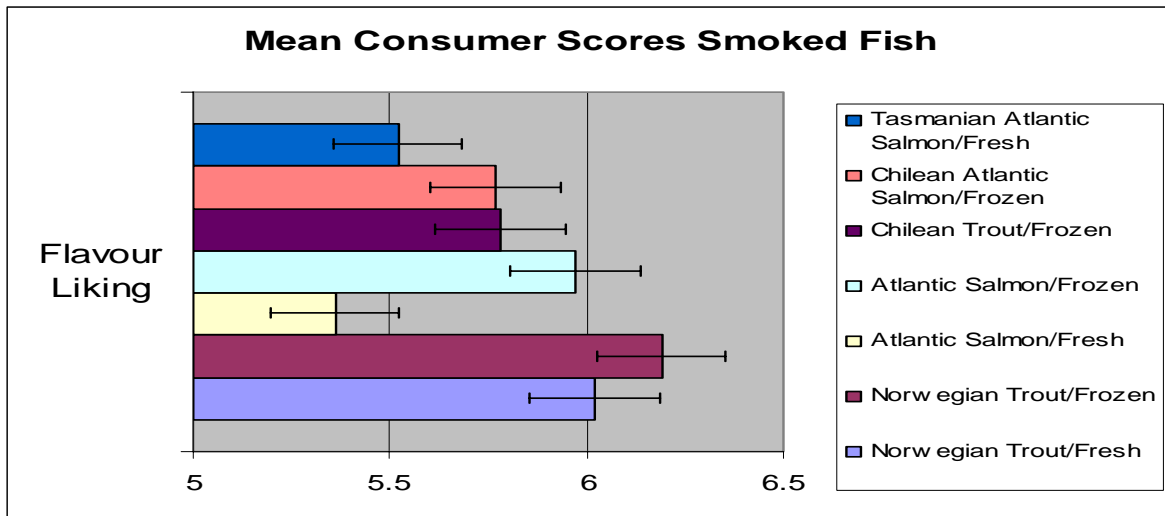


Figure 2. Mean score on judgement of flavour in smoked products.

The evaluation of the flavour of the products is, as expected, absolutely essential for the consumers. We see that evaluation of “flavour liking” is almost identical to the total evaluation or the “Overall liking” (see Fig. 1). An explanation to why fresh salmon scored so low could be that fresh salmon in Japan normally goes to the supermarkets – for use in sushi and sashimi products. In Japan, fresh salmon is usually not used for processed products or for smoking.

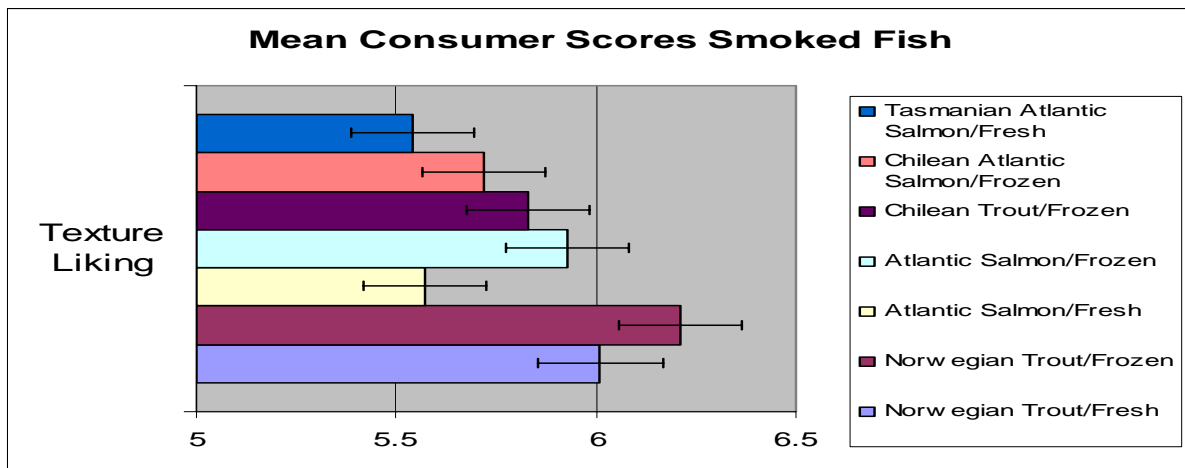


Figure 3. Mean score on judgement of texture in smoked products.

Regarding texture, the preferences seem to go in the same directions as in Fig 1 and 2. Both fresh and frozen Norwegian trout were mostly preferred. Chilean trout and Norwegian frozen salmon were not judged significantly differently, but both were significantly different in texture in relation to Norwegian frozen trout.

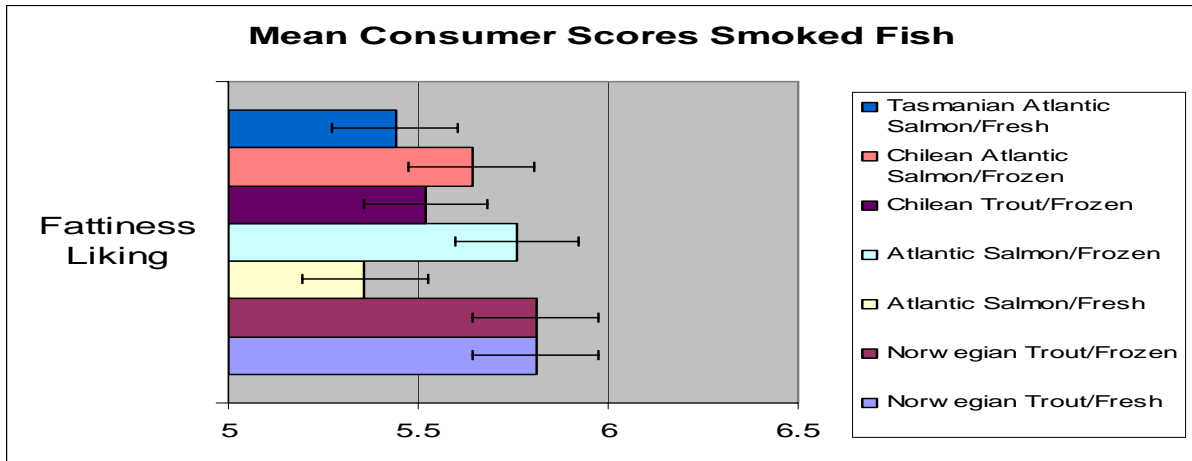


Figure 4. Mean score on judgement of fat content in smoked products.

With regard to the fat content, the relative differences between the products were less noticeable. Once again, Norwegian trout came out best, but not significantly better than frozen Norwegian salmon. Fresh Atlantic and Tasmanian salmon were given the lowest mean scores. The consumers were also asked to evaluate the intensity of several of the attributes, including how distinct they thought the fat flavour was in the products. Here, we registered marginal differences between the products, with the exception of Tasmanian salmon, which scored significantly lower than all the others.

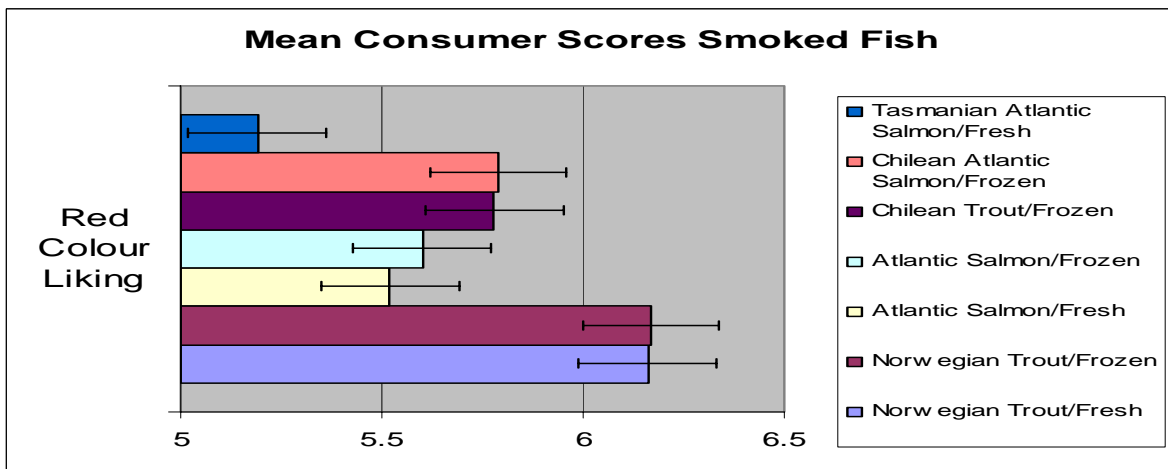


Figure 5. Mean score on judgement of colour in smoked products.

The fish meat colour is a very important attribute for the consumers, not least when it concerns salmon products. From studies in Europe, we also know that the customers use the red colour as an indicator of quality.

From figure 5 we see that both fresh and frozen Norwegian trout scored significantly higher than any of the other products. The consumers really liked the colour of Norwegian trout. What is surprising is that Chilean trout in this context was lesser preferred than the Norwegian trout. Many traders in Japan believe that Chilean trout has a “better” red colour than, for example, the Norwegian trout. This corresponds partly with our results in the sense

that the consumers considered the red colour in frozen Chilean trout at least as intense as in the Norwegian sample (see figure 6). The results from the expert panel conducting a sensory analysis of the same products also showed that Norwegian and Chilean trout were considered to have equal red colour (and better than the other products, see fig 8). At the same, it seems as though the consumers liked the red colour of the Norwegian trout best. Why?

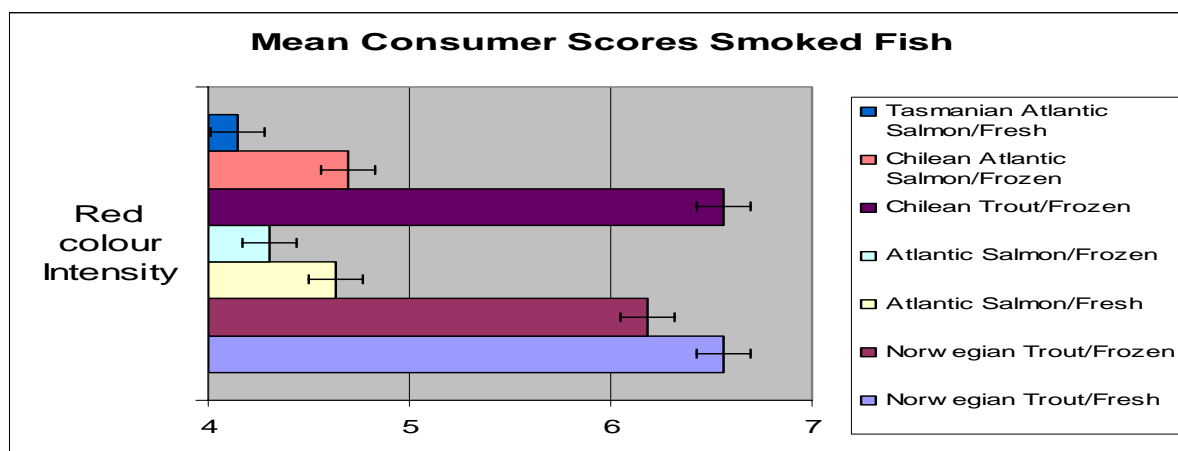


Figure 6. Mean score on judgement of the colour intensity in smoked products.

A possible explanation could be that the use of different colouring ingredients vary between countries/regions. The use of pure cantaxhantin, or in mixture with astaxhantin is known to give a deeper red colour than astaxhantin alone. Since we did not do any technical analysis of the samples, we can not confirm this. But it appears from our results that a “wrong” mixture of canta/asta may result in a “little too much of a good thing” when the product is to be smoked. This conclusion is supported by the Repertory Grid Analyses where the consumers gave their perceptions of, and put words to the differences between the samples. In this analysis we can see that “artificially coloured” is used by a number of participants as a descriptor for the red colour. Chilean salmon is almost at the top when an analysis is run on how the products are positioned in relation to this descriptor.

A conclusion on the results for colour could be that for the consumers, it is possibly not correct that “the redder, the better”. The colour in the product must also be perceived as “natural”, not “artificial” in depth or intensity. Due to this, the Norwegian trouts were given the most favourable scores.

4.2 Sensorial evaluation of smoked products

The sensorial evaluation of the 14 product samples was executed using the panel at Kikkoman Co. Aroma was described using 9 attributes, appearance using 3 attributes, taste and flavour using 8 attributes and texture using 3 attributes. In total 23 attributes. Here we only show the results from the attributes red colour, fat content and content of white stripes.

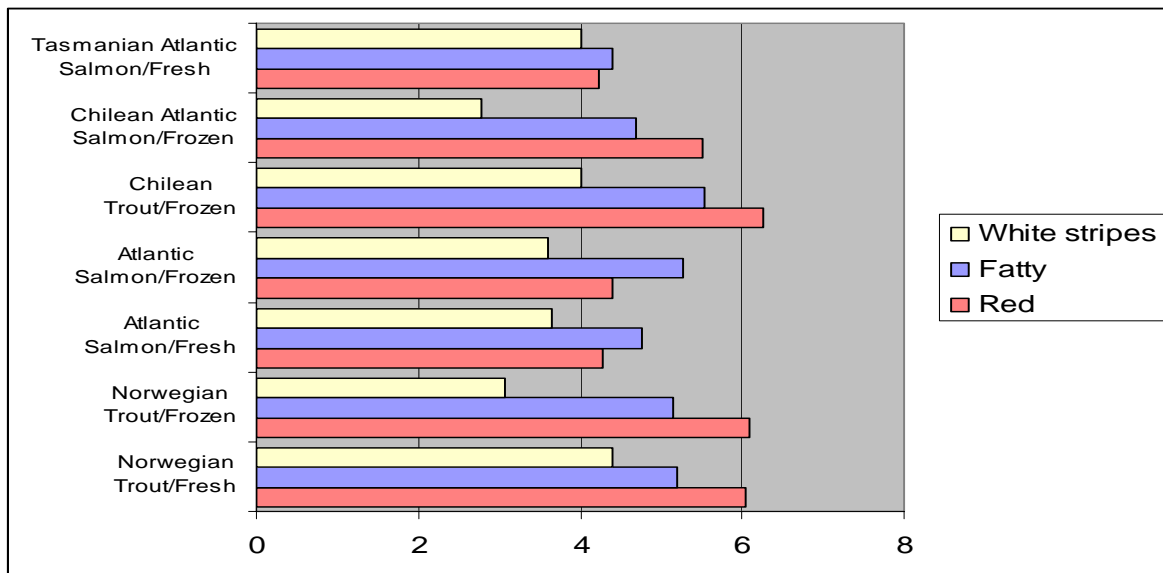


Figure 7. Expert panel evaluation of colour, fat and white stripes in product samples.

As can be seen from Figure 7, the different trouts and the Chilean Atlantic salmon are described as the products being most red. The fat content oscillates around 5 for all products. Looking at the results for the content of white stripes in the flesh we see that the Tasmanian Salmon, the Chilean Frozen Trout and the Norwegian Fresh Trout were considered almost equal. The Chilean Atlantic Salmon contains the least amount of white stripes. For the other sensorial attributes the differences are in the same range, meaning that from a sensorial point of view there was surprisingly small differences between the 7 products.

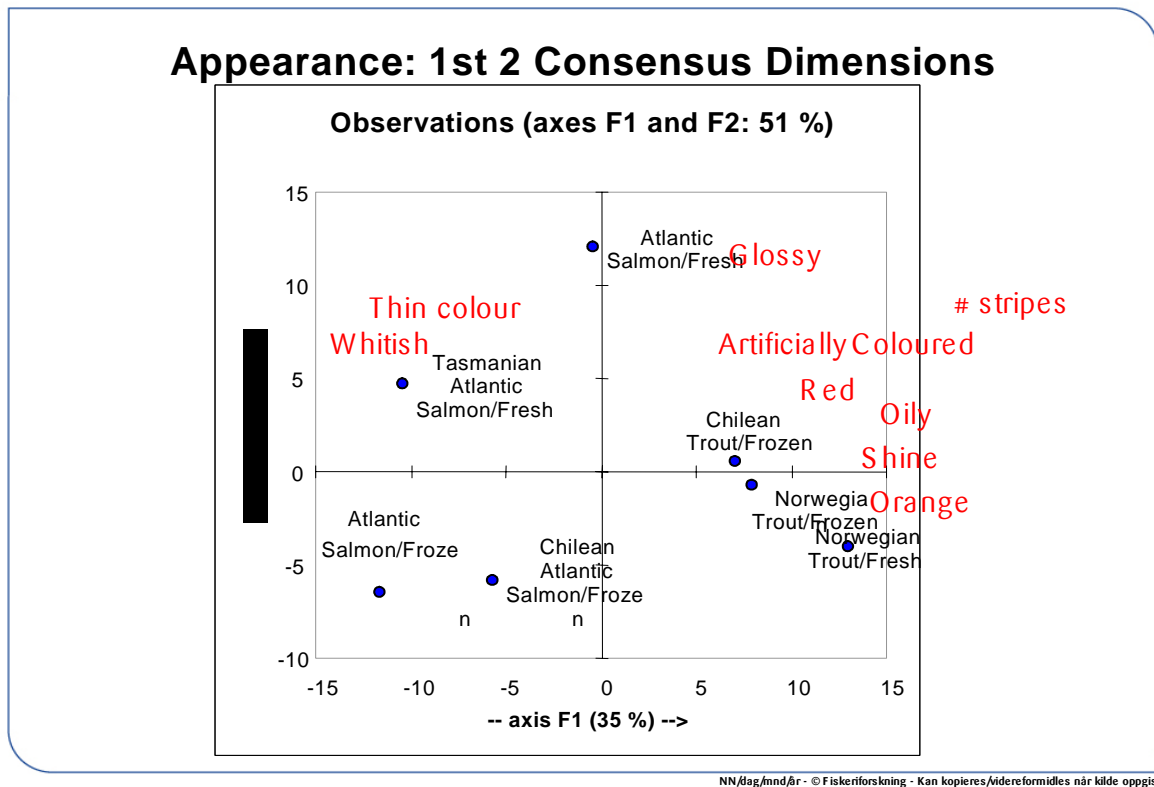
4.3 Perceptions of smoked products

25 persons in Tokyo and 25 in Osaka were invited to describe the 14 products just by visual inspection. The perceptions to describe were for the product categories texture, aroma, flavour and in-mouth attributes. The participants used their own words in the description of their perception and the frequency of these words were recorded and used in the analyses. The participants also indicated the strength/presence of the attributes on a 9-point scale. A total of 801 words were recorded. For the consumer lexicon only those words with a frequency of three or more were included. In this part we will only present the results from the analyses of the smoked products attributes appearance and flavour

The GPA analyses were performed and [Figure 8](#) shows the score-plot for the attribute appearance of the 7 smoked products. These maps or score-plots should be interpreted as follows: Products situated close to each other are perceived as similar (substitutes), while products situated far apart are perceived as very distinct from each other. The Chilean Trout/Frozen, and the two Norwegian Trout products are perceived as similar and different from the other four products. Atlantic and Chilean frozen Salmon stick together while Tasmanian salmon and Atlantic fresh Salmon seem to have little in common with the others. A loading plot using the frequency of some of the words used by the consumers to describe the appearance are also presented in figure 9. The interpretation of this map is as follows: From origo (0,0) one draws a line out to the descriptor (vector) thus indicating that the descriptor points in that direction. Comparing the direction of the descriptors to the product position in figure 9, the interpretation would be that products occupying i.e. the upper right

quadrant are characterised by the presence of the descriptors in the same location and the absence of the descriptors pointing in the opposite direction. Due to limited space we only show these maps once and due to the number of descriptors the loading plot contains only a few of them. In the following we will only present the results from the attributes *appearance* and *flavour*.

4.3.1 Consumer perceptions of *appearance* for smoked products



NN/dag/mnd/år - © Fiskeriforskning - Kan kopieres/videreformidles når kilde oppgis

Figure 8. Perceptions of appearance for smoked products.

Combining the maps shown in figure 8 for the attribute appearance we find that for the smoked products we can sum up the results as follows:

The Norwegian Trout/fresh is perceived as orange with clear stripes. This is “confirmed” by the absence of descriptors like whitish and thin colour being the ones mostly pinned to the Tasmanian Atlantic fresh Salmon. The Norwegian and Chilean frozen Trout are perceived as more reddish, oily and with many stripes. In the same area we find descriptors like glossy and artificially coloured. The last two also entangles fresh Atlantic salmon. The Atlantic frozen Salmon and the Chilean Atlantic frozen Salmon are entangled to the descriptors whitish and thin colour.

4.3.2 Consumer perceptions of *flavour* for smoked products

The same methodology was used as explained above and the interpretations of the results became problematic probably due to special Japanese words used for the descriptors. This means that most products were perceived as fishy, oily and smoked, but since each of these descriptors points in opposite direction, it is possible that English lacks the level of precision the Japanese language contains. The situation is the same for the Japanese word “umami”.

4.3.3 Combined products and expert panel perceptions for smoked products

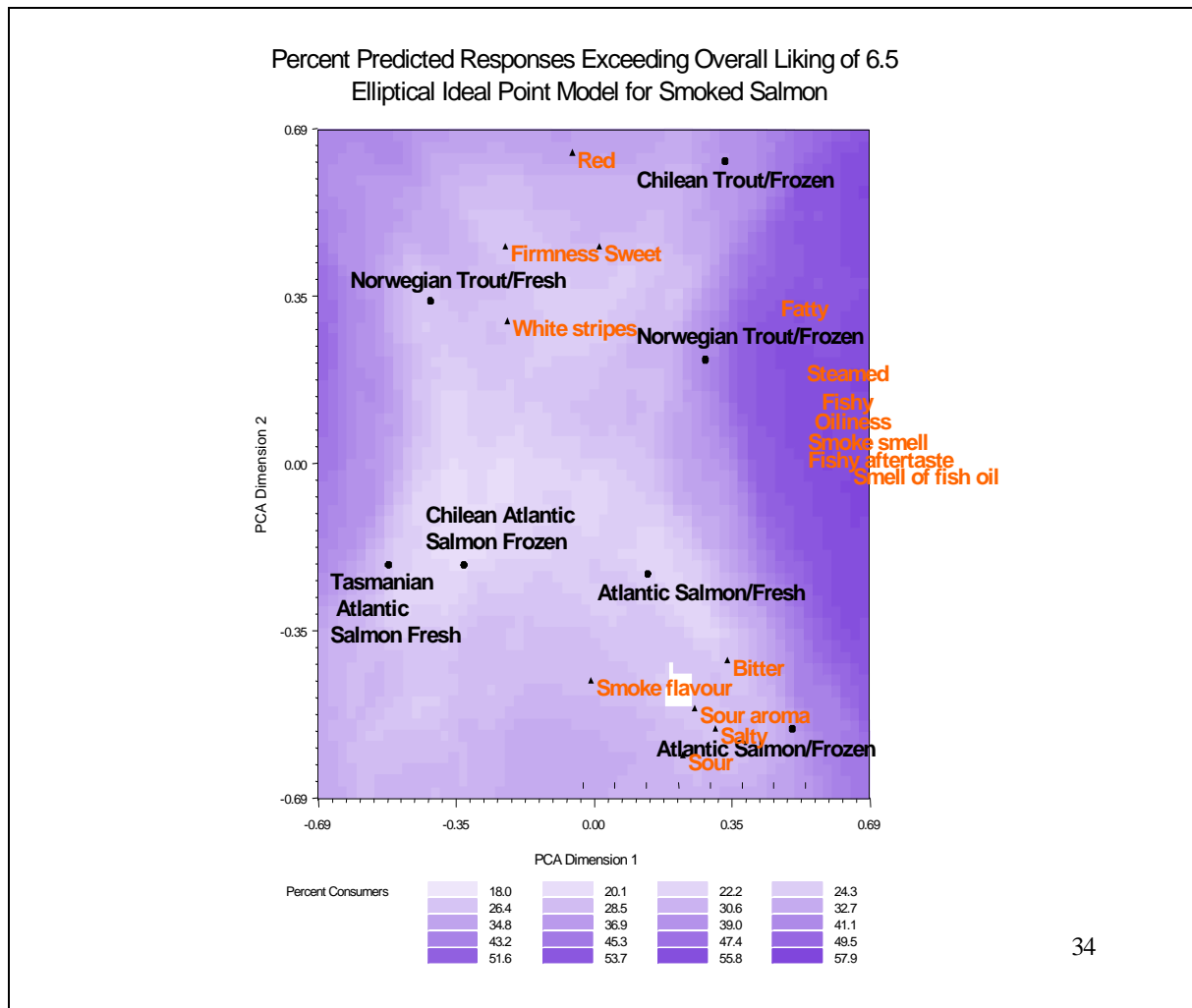


Figure 9. Perceptual Mapping for smoked products.

The Perceptual Map in Figure 9 shows how the expert sensory panel perceived the 7 smoked products using visual inspection. The perceptions are mapped together with the products. This is done so that two products occupying positions close to each other are perceived as being alike in sensory properties. At the same time the perceived descriptors hook to the products lying closest in the map.

Products that are positioned in or up against the dark fields will have greater probability of being preferred (best liked) in the market. The darker the (blue) colour, the larger share of the respondents would give a score above 6.5 for “overall liking” or total satisfaction with the

product. In the above figure, we see, for example, that *Norwegian Trout/frozen* is positioned up to the right, close to the bluest field. This is a favourable position, and can be explained with the following product properties:

- Good red colour
- firm texture
- distinct fishy flavour
- distinct (high) fat content (including good marbling = white stripes.)

The map also shows that there could be a segment (left part of Figure 7) that prefers products without too much flavour.

4.4 Summary – smoked products, preferences and perceptions.

- **Norwegian trout, both fresh and frozen were the most preferred products.**
- **Trout had a more preferred red colour than the salmon products.**
- **Norwegian trout had equally good colour as Chilean trout. Chilean trout was perceived as having a more “unnatural” colour**
- **High levels of “Fishy flavour” and “Oily flavour” were perceived as favourable for the consumers’ satisfaction with the product.**
- **Evaluation of the packed products indicated increased satisfaction with Norwegian trout after tasting.**

5 SASHIMI PRODUCTS

5.1 Consumer Preferences of sashimi

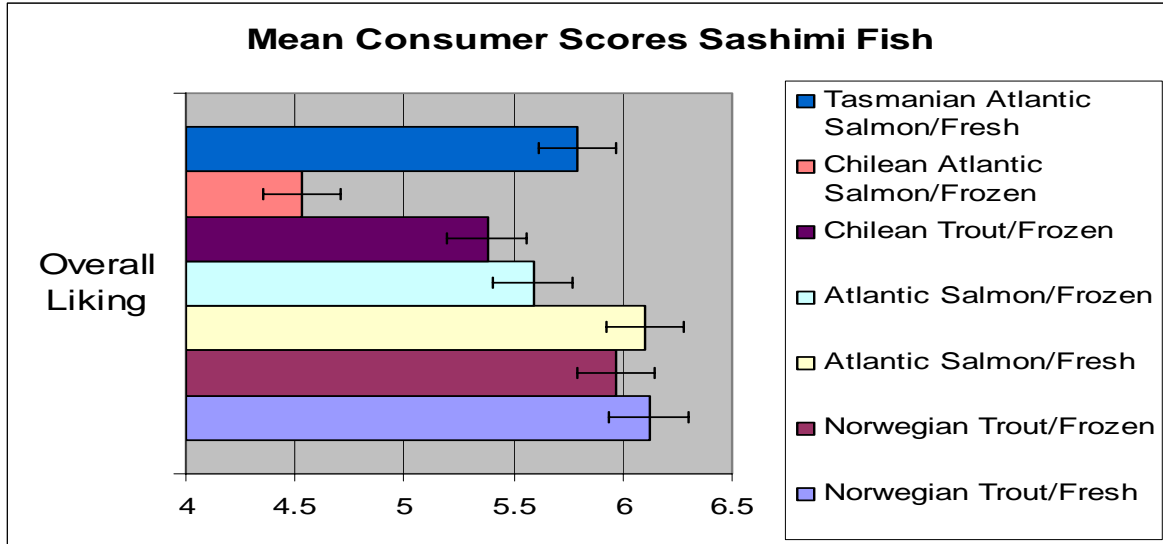


Figure 10. Mean score for total satisfaction for sashimi salmon and trout.

Rather surprisingly, Norwegian trout for use in *sashimi* was also given high scores by the consumers. From what we could expect, fresh Norwegian salmon and fresh Tasmanian salmon were also evaluated positively by the consumers. Tasmanian salmon in particular came out much better for use as sashimi than as a smoked product. Conversely, we see that frozen Chilean salmon scored significantly lower than the six remaining products tested. The mean overall liking score for this product was as low as 4,5 – the lowest score registered in the whole test. As seen from the figures below it was a similar pattern between the tested products when it came to the specific quality attributes: Flavour, texture, fat content and colour.

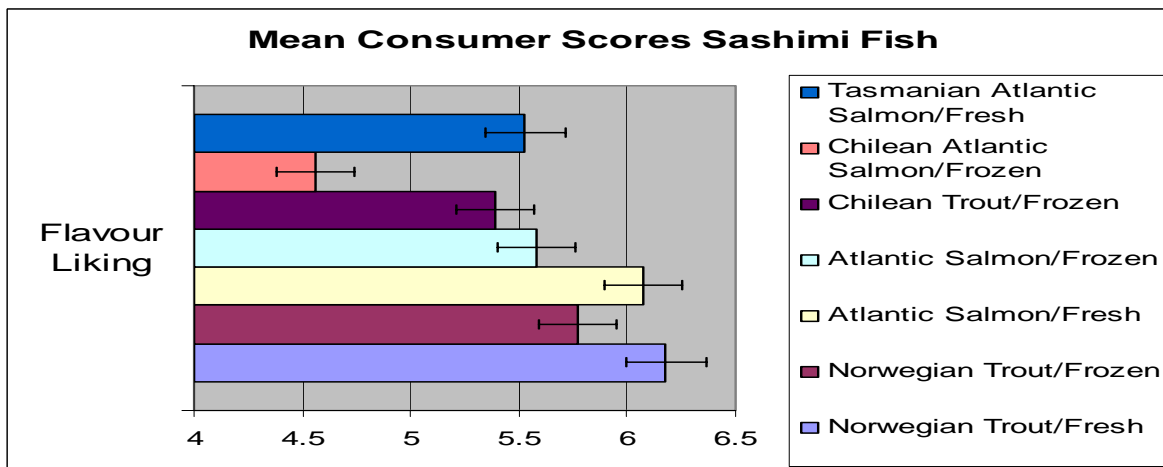


Figure 11. Score of flavour liking sashimi products.

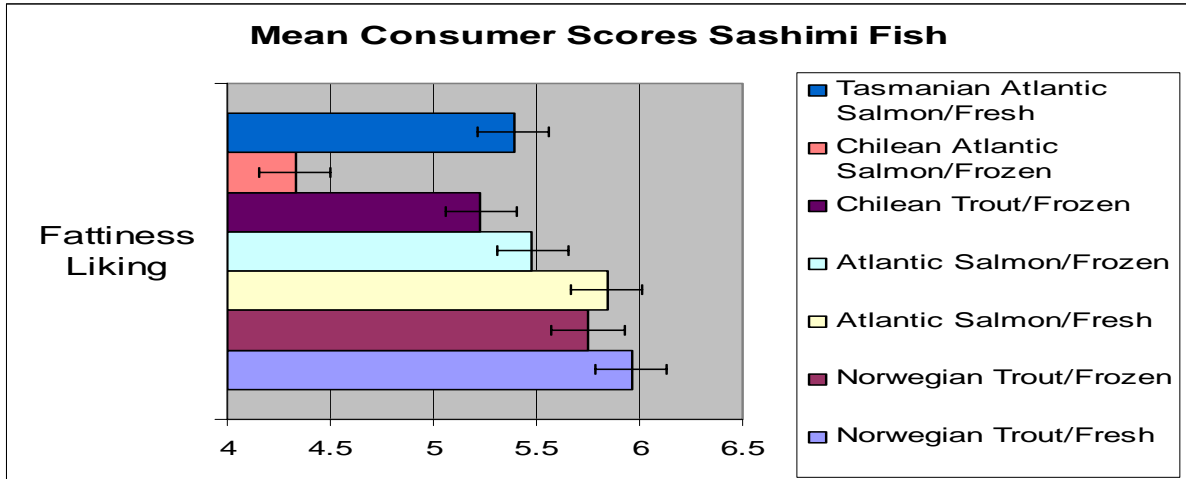


Figure 12. Score of fattiness liking sashimi products.

Scores on fattiness liking showed a similar pattern as for overall liking. Fresh Atlantic salmon, fresh and frozen trout were given a slightly higher mean score than frozen Atlantic salmon, fresh Tasmanian salmon and frozen Chilean trout. Frozen Chilean salmon scored significantly lower than any other product also on this attribute.

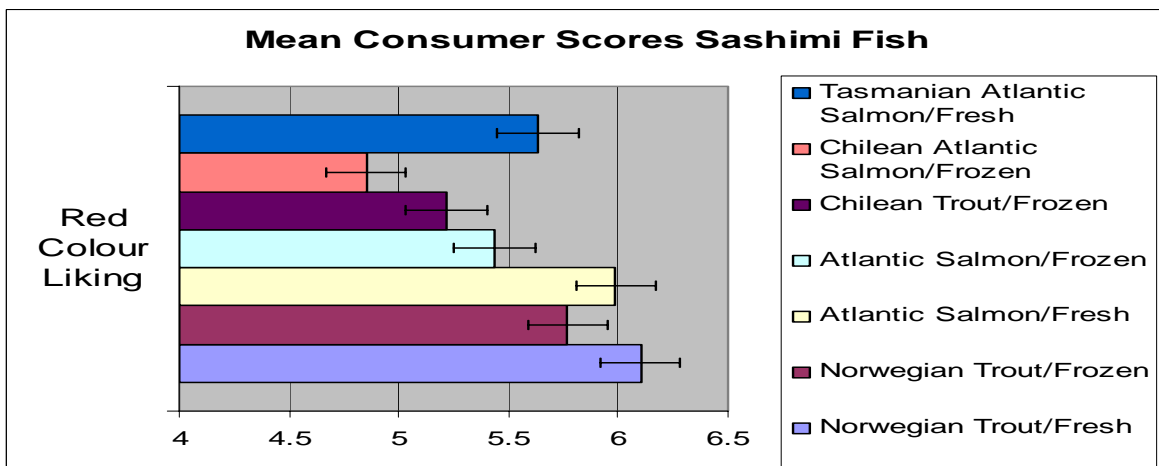


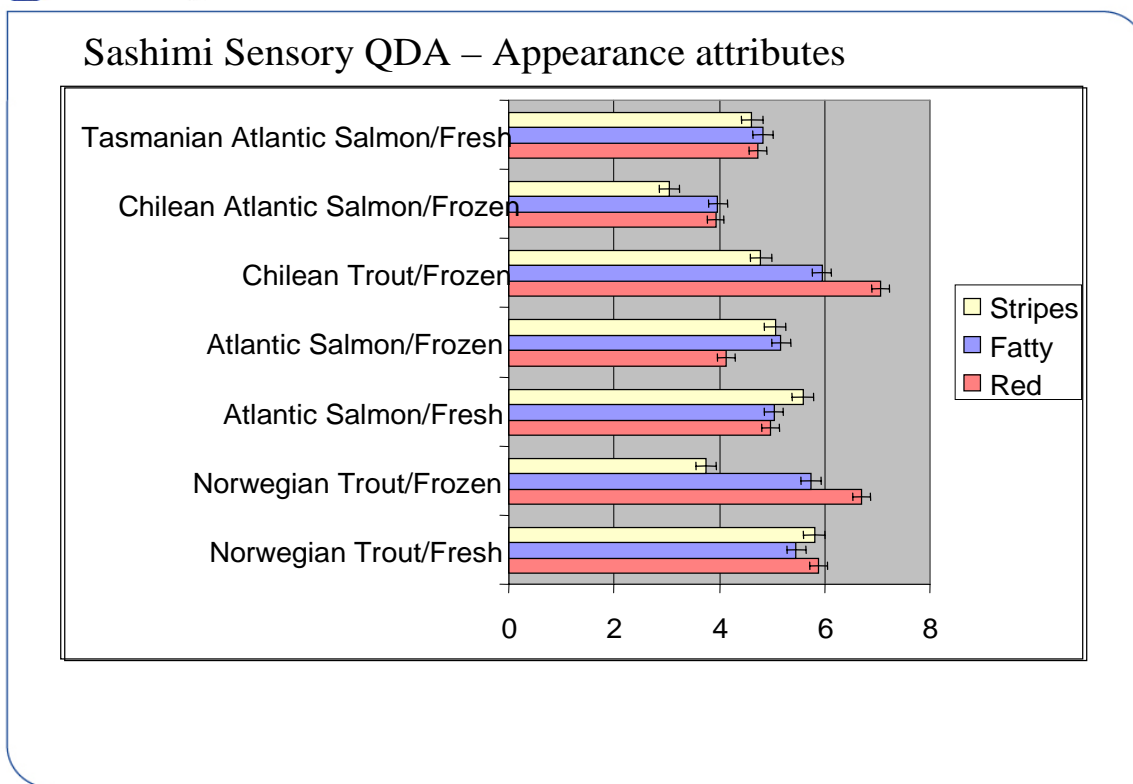
Figure 13. Score of red colour liking of sashimi products.

For *sashimi*, the intensity of the red colour in Chilean trout was evaluated higher than in any of the other products, cf. discussion of the same theme for smoked products. In spite of this, Norwegian trout scored better with the consumers concerning satisfaction with the colour.

5.2 Sensorial evaluation of sashimi products

In Figure 13 the results from the sensorial evaluation of the attributes red colour, fat content and white stripes can be seen. Again the trout products were described as being the most reddish, while the frozen Chilean Atlantic Salmon and the fresh Atlantic Salmon were the least reddish. The trout products were also the fattiest together with fresh and frozen Atlantic Salmon. The presence of stripes (marbling or distinct fat deposits in the muscle) is also quite

distinct in fresh Norwegian Trout, fresh Atlantic Salmon, frozen Atlantic Salmon, frozen Chilean Trout and fresh Tasmanian Salmon. When it comes to the other sensorial attributes, the differences were surprisingly small.



NN/tdag/mnd/år - © Fiskeriforskning - Kan kopieres/widerefordles når kilde oppgis

Figure 14. Expert panel evaluation of red colour, fat content and stripes in sashimi products

5.3 Perceptions of sashimi products

For methodological details see Chapter 4.3

5.3.1 Consumer perception of appearance of sashimi products

In [Figure 14](#) we see the score plot for the perceptions of the appearance of the 7 “Sashimi” products. The relative positions for the 7 products are distinct from the positions presented in [figure 9](#). Norwegian and Chilean Frozen Trout are perceived as close (Group 1), the same with Fresh Atlantic Salmon and Fresh Trout (Group 2). Atlantic Frozen Salmon and Fresh Tasmanian Salmon are also close (Group 3), but the one that really sticks out by being perceived differently is the Chilean Frozen Salmon. When we look at the loading plots (not shown) for the descriptors we find that the fish in Group 1 are located close to the descriptors artificial coloured of red or orange, freshness, glossy, shiny and a thick slice. The fish in Group 2 are perceived as fatty, dark coloured, oily, marbled (stripy) and transparent. The fish in group 3 are perceived as dark coloured, salmon like, with stripes. The Chilean frozen salmon is primarily perceived by the absence of all the descriptors used for the other groups plus lean and whitish.

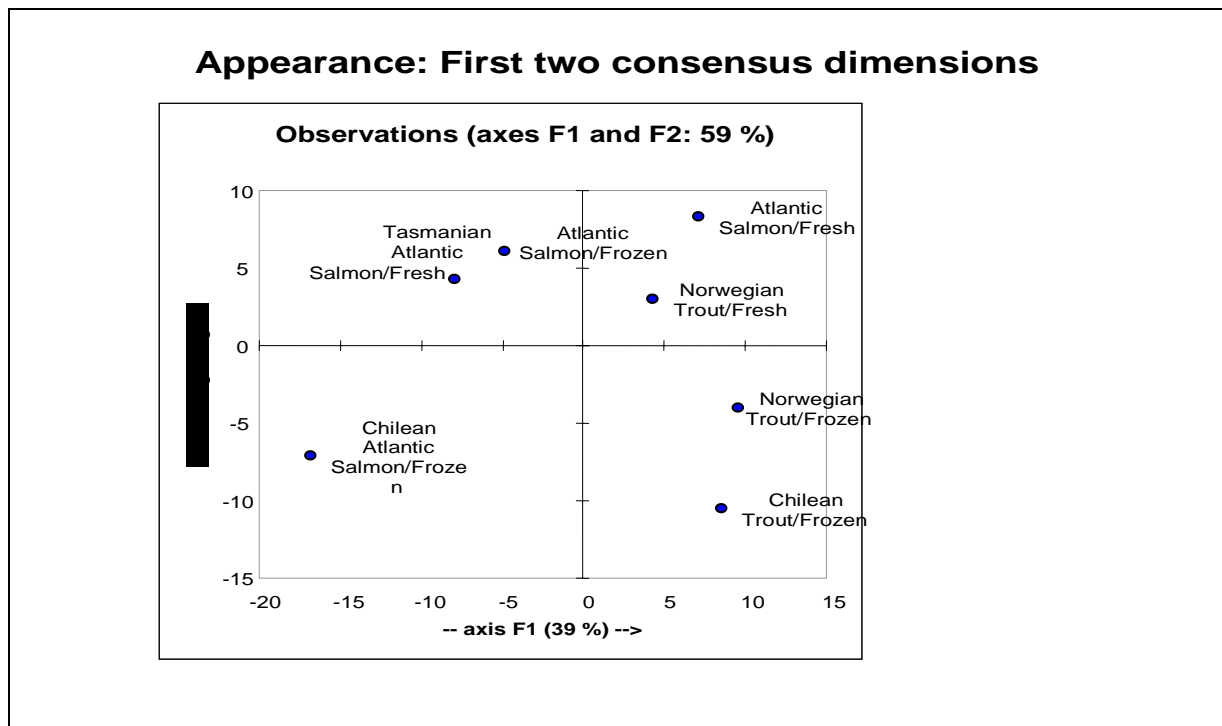


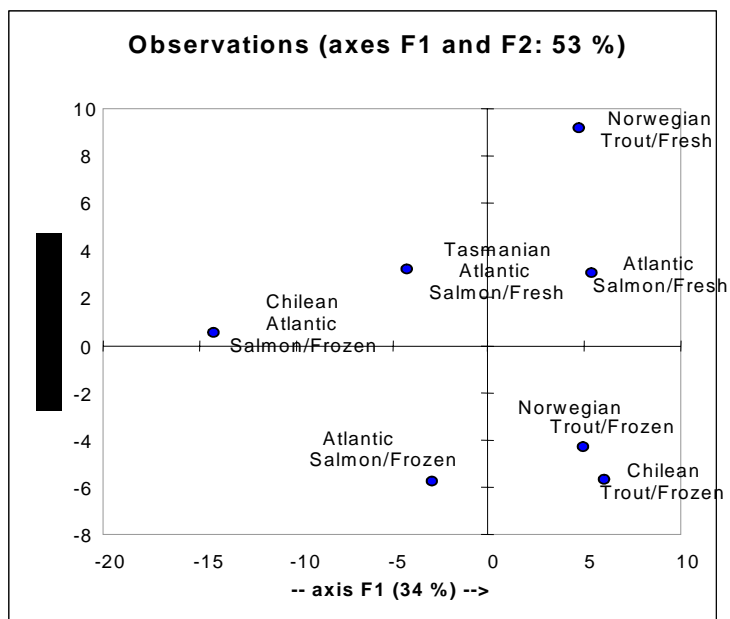
Figure 15 Perception of appearance of sashimi products.

5.3.2 Consumer perception of *flavour* of sashimi products

Figure 15 shows the score plot for flavour for the first two consensus dimensions, and we see that the products group differ from the same plot for appearance. Chilean frozen Salmon is still perceived as different from the other 6 products, and apart from the Norwegian frozen Trout and the Chilean frozen Trout, the other products seem to be more evenly spread in the plot. Interesting to note though is the difference in frozen and fresh trout on one side and that Atlantic Frozen Salmon is located relatively close to the frozen trout. When we compare the relative positions to the loading plots for the descriptors (not shown), we summarise as follows:

Norwegian and Chilean frozen Trout are perceived using the descriptors fatty fish and body, sweet, salmon like and *umami*.

Flavour: First two consensus dimensions



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Figure 16. Perception of flavour of sashimi products.

Frozen Atlantic salmon hooks to the descriptors fishy, fatty and heavy. Fresh Atlantic salmon and fresh Norwegian Trout and perceived as fatty, oily, sweet, *umami* (of fish). Frozen Chilean Atlantic Salmon and to a certain extent the Fresh Tasmanian Atlantic Salmon are perceived as plain and watery and the absence of most of the descriptors used for the other 5 products.

5.3.3 Combined products and expert panel perceptions for sashimi products

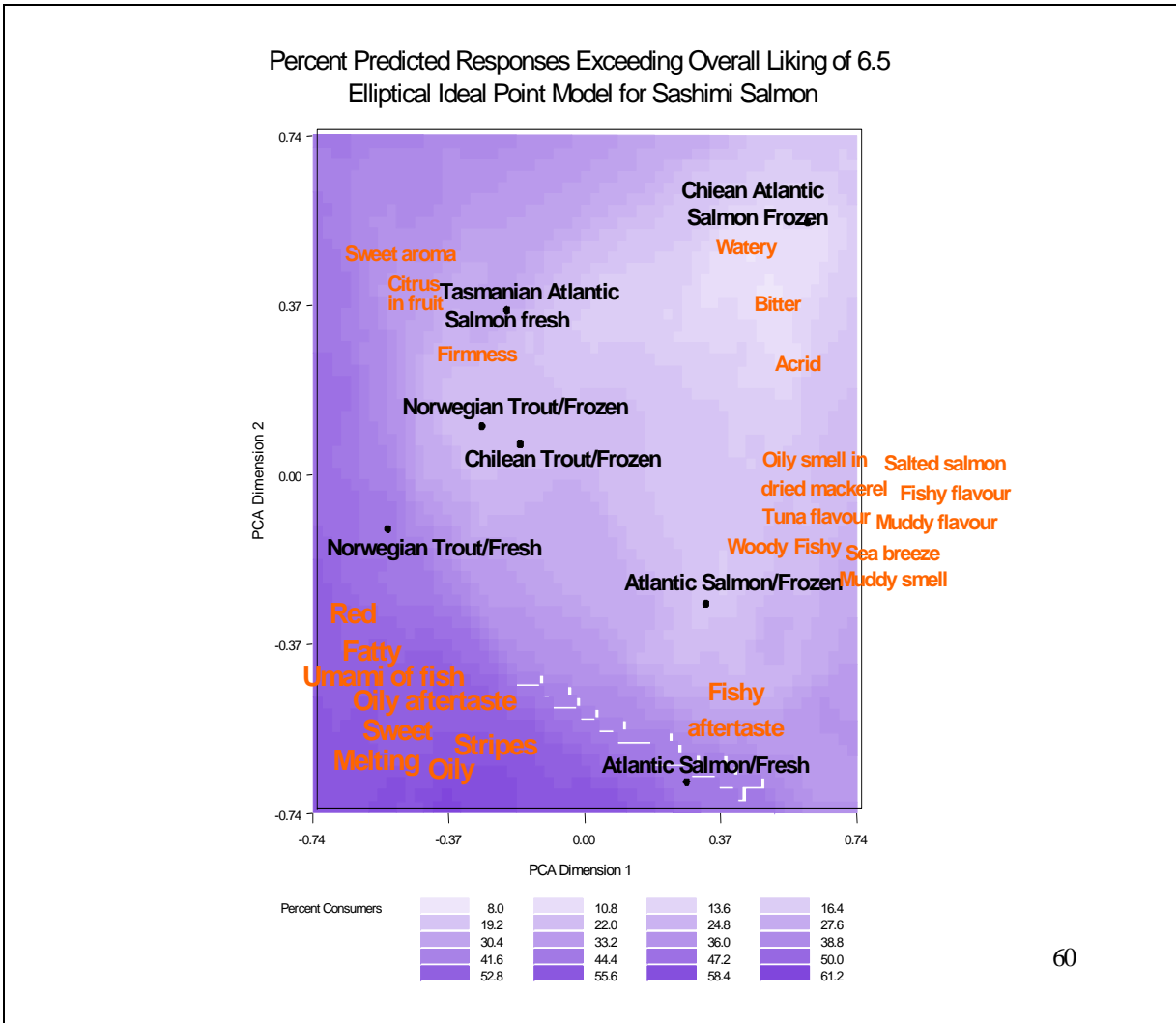


Figure 17. Perceptual Mapping for sashimi products.

Evaluated by the sensory panel, we see that fresh Norwegian trout is well positioned inside a dark blue area of the preference map. Fresh Norwegian salmon and fresh Tasmanian salmon are also positioned right up against the most coloured parts of the map. This agrees with the results obtained through the consumer surveys.

Distinct stripes (good fat marbling), good red colour and “oily” aftertaste are product attributes that can improve the total satisfaction with the product.

From the preference map, we can also see that the Tasmanian salmon is characterised by “a sweet aroma”, “citrus in fruit” and “firmness”. It appears that Tasmanian salmon is less distinct in flavour and is characterised by greater “firmness”.

5.4 Summary - Sashimi

- **Norwegian trout (fresh and frozen) and fresh Norwegian salmon had the highest preference.**
- **These products had a good red colour and scored high because of the fat content.**
- **Preference Mapping indicates that a high fat content, “oily” aftertaste, “sweetness”, “melting texture”/elastic texture, and distinct/visible white “fat” stripes are favourable attributes for sashimi salmonoid products.**
- **The consumers’ experiences exceeded the expectation regarding the Norwegian trout (i.e. their score after having tasted the product was higher than the score they gave to the package, based only on appearance). On the other hand, Chilean Atlantic salmon only barely fulfilled their expectations.**



Fiskeriforskning

Tromsø (head office)
Muninbakken 9-13, Breivika
P.O.box 6122
NO-9291 Tromsø
Norway
Tel.: +47 77 62 90 00
Fax: +47 77 62 91 00
E-mail: post@fiskeriforskning.no

Bergen
Kjerreidviken 16
NO-5141 Fyllingsdalen
Norway
Tel.: +47 55 50 12 00
Fax: +47 55 50 12 99
E-mail: office@fiskeriforskning.no

Internet: www.fiskeriforskning.no

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