Title: A SYSTEM AND METHOD FOR SORTING OF ITEMS PRIOR TO PROCESSING

Abstract: System and method for processing of food items, in particular fish, involving at least two processing stations. For example, gutting or filleting machines for processing of fish. The system comprises measuring or detecting means for determining or estimating a length dimension and weight or a value corresponding to the weight of each item. Furthermore, the system comprises means for delivering a food item, e.g. a fish, to a selected processing station. The system may be a manual processing station.
A SYSTEM AND METHOD FOR SORTING OF ITEMS PRIOR TO PROCESSING

Field of the invention

The invention relates to a system for processing of food items, in particular fish, wherein the system comprises at least two processing stations for processing of the food items such as for example gutting or filleting machines for processing of fish.

Further, the invention relates to a method for processing of food items such as in particular fish.

Background of the invention

Within the field of processing of fish, for example salmon, it is known to perform a gutting or filleting of the fish by means of a plurality of work stations, to which the fish are delivered randomly, e.g. in the sequence, in which the fish are supplied. Further, it is known that such work stations may be manual work stations, and further it is known that automated machinery may be used for such processing of fish.

In particular when automated machinery is used for processing of fish it may be expedient to grade the fish prior to the processing of the fish. Examples of such prior art will be mentioned in the following.

EP 0 331 390 A2 relates to a fish sorting machine, in particular for sorting of fish according to specie of the fish. The sorting machine comprises a video camera and an image processor for determining areas, length and width of the images obtained by the camera. Further, the sorting machine can determine ratios of predetermined ones of the areas, length and/or width in order to determine the specie of the fish and furthermore, on the basis of the determined areas, the weight can be calculated.
WO 94/09920 A1 discloses a similar fish sorting machine having video camera and processor means for determining not only the shape of the fish, e.g. various aspect ratios, but also the colour and/or light intensity of predetermined areas as an aid for sorting the fish into species.

US 4,051,952 A discloses an apparatus for detecting a characteristic of a fish by means of a radiant energy source and detector and for effecting a sorting of the supplied fish on the basis of the characteristic in order to facilitate processing of the fish. The characteristic may be the length, the sex or the sidewise orientation of the fish.

US 5,181,879 A relates to a method and apparatus for processing offish such as tuna into sections using a plurality of cutting work stations arranged in a sequential manner. Prior to the processing the fish are graded into groups of substantially similar size and weight.

WO 01/72613 A discloses a method and apparatus for receiving and delivering oblong objects such as fish, which have been graded in advance. The grading can be by weight, length or computer image, but has otherwise not been disclosed.

SU 514598 A1 relates to fish sorting equipment for ship or shore based factories. The thickness (mass) of the fish is determined as well as the length to mass ratio of the fish.

JP 8050052 A relates to a system for measuring length and weight of live fish, i.e. during culturing of the fish, and for sorting the fish accordingly. The fish pass along with a water stream through a chute, where by means of a weighing cell the weight is determined and where by means of a camera the length is determined. Based on these measurements, e.g. a comparison of the length and the weight by a control device a sorting is performed by a sorting device, by means of which the fish is directed to
different chutes. Thus, it is noted that this prior art is related to the sorting of live fish and is not related to the processing of slaughtered fish.

It is an object of the invention to provide an improved system and method for processing of food items and in particular fish.

In particular, it is an object of the invention to provide such an improved system and such a method for processing of fish, whereby the processing, e.g. the gutting and/or filleting of for example fish can be optimized, and whereby further the handling of such items such as fish can be adapted in dependence on the individual characteristics of the fish.

These and other advantages of the invention will be further explained in the following.

The invention

The invention relates to a system for processing of food items, wherein said system comprises at least two processing stations for processing of said food items, wherein the system further comprises
- measuring or detecting means for determining or estimating a length dimension L and weight or a value corresponding to the weight W of individual food items,
- means for providing a condition factor K for individual food items based on said determined or estimated values for the length dimension L and weight or a value corresponding to the weight W of said individual food items, and
- means for delivering individual food items to a selected processing station in dependence on said condition factor K for said individual food items.

Further, the invention relates to a method of processing of food items whereby the food items are delivered to at least two processing stations for processing of food items, whereby
- data relating to a length dimension \( L \) and weight or a value corresponding to the weight \( W \) of a food item is provided by measuring or detecting means, whereby
- a condition factor \( K \) is provided for said food item, based on said data relating to the length dimension \( L \) and weight or a value corresponding to the weight \( W \) of the food item, and whereby
- said food item is delivered to a selected processing station in dependence on said condition factor \( K \).

Hereby, a number of advantages are obtained with respect to the prior art, including an optimized processing of the items, for example fish.

The condition factor, \( K \), has been used for over a century as a measure for the "condition" of fish, specifically the amount of muscle and fat compared to its general size or length. The conventional measure is:

\[
K \sim \frac{W}{L^N}
\]

where \( W \) is the weight of the fish, \( L \) is its length and the power, \( N \), is usually taken to be equal to 3. Furthermore, this quantity may be multiplied by a constant scaling factor. The rationale for using \( N=3 \) is that if the fish is assumed to grow in the same proportions in all dimensions (length, width and thickness), and the mass distribution within the fish does not change, this ratio will remain unchanged for all sizes of fish.

Hence, when using the condition factor \( K \) based on the length dimension \( L \) as well as the weight or a value corresponding to the weight \( W \) of e.g. the fish, the condition factor will be indicative of not only the size of the fish, but also the general condition of the fish. Thus, the individual processing stations, e.g. gutting or filleting machines can each be used for processing fish having a \( K \) factor (condition factor \( K \)) within a predetermined range, where the ranges may differ from automated station to automated station, and whereby for example each station may be adapted for specifically processing fish having a \( K \) factor within a certain range. Hereby, an optimized processing can be laid out for the individual items in dependence on the
individual conditions. For example, the processing stations, e.g. the gutting or filleting machines can be optimized in a better manner if fish with similar condition are graded into the machines, thus also resulting in an improved yield and an improved quality of the products.

It is noted that the items, e.g. the fish can be selectively delivered to the processing stations in dependence on other parameters as well in addition to the condition factor K. For example, the weight alone, the orientation of e.g. the fish, etc. can be taken in account also when deciding to which processing station a specific food item, e.g. a specific fish should be directed.

Expediently, as stated in claims 2 and 14, respectively, said food items may be fish and said at least two processing stations for processing of said food items may be for example gutting or filleting machines for processing of fish.

Further, as characterized in claims 3 and 15, respectively, said means for providing a condition factor K based on said determined or estimated values may involve use of an equation for determining the factor K, possibly in approximated form.

Even further, as characterized in claims 4 and 16, respectively, said means for providing a condition factor K based on said determined or estimated values may involve use of a lookup table.

According to a further embodiment, as characterized in claims 5 and 17, respectively, said means for providing a condition factor K based on said determined or estimated values may involve use of an artificial neural network and/or a fuzzy logic system.

According to an even further embodiment, as characterized in claims 6 and 18, respectively, said means for providing a condition factor K based on said determined or estimated values may involve further measuring or detection means such as equipment for providing data regarding material composition, density and/or density
variations of the items, which equipment may provide X-ray measurements, nuclear magnetic resonance (NMR or MR) measurements, etc.

Thus, in addition to the measurement of weight, length, and possibly other external geometric attributes, such as the width, the condition factor may be estimated through the above-mentioned other means of measurements. These include:

- X-ray measurements, which reveal the density variations of the object.
- Nuclear magnetic resonance (NMR or MR) measurements, which reveal the material composition and density.

Expediently, as defined in claims 7 and 19, respectively, said condition factor $K$ may involve a ratio between a first parameter $P_1$ based on the weight or a value corresponding to the weight $W$ of the item and a second parameter $P_2$ based on the length dimension $L$ of the item, or the condition factor $K$ may involve the reciprocal of said ratio.

The condition factor may be a function $f(L,W)$ of the length dimension $L$ as well as the weight or a value corresponding to the weight $W$ of the item, e.g. the fish and according to this embodiment the condition factor $K$ may be calculated as a ratio between a first parameter $P_1$, which is based on the measured or estimated weight or a value corresponding to the weight $W$ and a second parameter $P_2$, which is based on the measured or estimated length dimension $L$. Thus, it will be understood that the parameters $P_1$ and $P_2$ may be functions of the weight or a value corresponding to the weight $W$ and the length dimension $L$, respectively. Hereby, the condition factor $K$ may be provided in an expedient manner and whereby the condition factor $K$ will directly indicate the condition in general, e.g. a high condition factor will indicate a good condition, whereas a low condition factor will indicate a thin fish, possibly in a poor condition, or vice versa, when the reciprocal value is used.

It is noted that the length dimension $L$ of the individual items, e.g. the individual fish, may preferably be the length of each fish understood as the length from nose to tail.
But it will be understood that other length dimensions which are indicative of the length of the fish can be used, for example the length along the upper or lower part of the fish from nose to tail, or for example the length of a characteristic part of the fish can be used if found expedient.

According to an advantageous embodiment, as defined in claims 8 and 20, respectively, said condition factor K may be defined as \( P_1/(P_2)^N \) or alternatively the condition factor K may be defined as the reciprocal value of this ratio.

Hereby, the processing may be further optimized since the condition factor K calculated in this manner may to a higher degree be indicative of the general condition of e.g. a fish.

Expediently, as stated in claims 9 and 21, respectively, \( 2 \leq N \leq 4 \).

It will be understood that the value of \( N \) within this interval may be selected from an infinite number of various values, for example a value selected from the numbers 2.0, 2.1, 2.2, 2.3, \( \ldots \ldots \), 3.6, 3.7, 3.8, 3.9 and 4.0 and any values in between these. Further, it will be understood that the value of \( N \) may be within an interval selected within the interval of \( 2 \leq N \leq 4 \), e.g. with endpoints selected from the range of numbers mentioned above, e.g. 3.2 \( \leq N \leq 3.8 \). The actual value of \( N \) and/or the actual size and endpoints of an interval may depend on the actual circumstances and/or the equipment, the type of food items, the species of fish, etc.

According to a further embodiment as stated in claims 10 and 22, respectively \( N = 3 \).

As it will be apparent to a skilled person, \( N \) may according to this embodiment be substantially or approximately 3, meaning that the exact value may differ from the value of e.g. exactly 3.0 and that the value of \( N \) may be found in a range about the exact value. The size of the range may depend on the actual circumstances and/or the equipment, the type of food items, the species of fish, etc.
According to a further advantageous embodiment, as defined in claims 11 and 23 respectively, said first parameter $P_1$ may be equal to the weight or a value corresponding to the weight $W$ of the item and said second parameter $P_2$ may be equal to the length dimension $L$ of the item.

Hereby, the $K$ factor may be calculated as $K = \frac{\text{Weight}}{\text{Length}^N}$, whereby, when fish are concerned, it is an indicator of how fat or thin the fish is, corresponding to the $K$ factor used for estimating the condition of live fish, where $N=3$. Thus, further optimization can be achieved when processing fish.

The above formula, $K = \frac{\text{Weight}}{\text{Length}^N}$, where $N = 3$, holds reasonably well in many instances. However, it may be advantageous to vary the power figure $N$ from the nominal value of 3. On one hand, this figure may be smaller, and this holds if the primary variations of the fish size are in two dimensions, such as for many flat fish species (flounder, sole, halibut, etc.). In those cases the width and the length may vary considerably while the corresponding variation of thickness may be less. In the ultimate case the size variation would be two-dimensional, which would result in $N=2$. On the other hand, the weight distribution and the composition of the fish changes as it grows, so the simplistic scaling does not entirely hold and measurements of cod weight vs. its length show a relationship that results in figures of $N$ over 3. Furthermore it has been observed, for example, that at a certain point cod slows down its growth in length without slowing down correspondingly its increase in weight. Thus, in connection with the invention, the measure of the condition of fish, based on equation $K = \frac{\text{Weight}}{\text{Length}^N}$, may generally be taken to be advantageous with $N=3$, but in practice there may be variations from this nominal figure and here advantages can be obtained within the range of 2 to 4.

According to a particular advantageous embodiment, as defined in claims 12 and 24, respectively, one of said at least two processing stations may be a manual processing station, e.g. for manual gutting or filleting offish.
Hereby, it is achieved that a fish that is abnormal, e.g. not within a normal range, such as a short tail fish or an extra thin and long fish can be directed into a manual processing station, e.g. a manual gutting station, where the processing may be performed in an optimal manner in view of the abnormal condition of the fish. Thus, it is avoided that such an abnormal fish is directed to an automated processing station, which might not be able to handle the fish or which will process the fish in a manner giving a substandard result. Thus, an enhanced yield of the processing is achieved by this embodiment. It is noted that this embodiment can involve not only a directing of the fish to either a manual processing station or to an automated processing station in dependence on the condition factor $K$, but also a directing of the fish to a particular, selected automated processing station, when two or more automated processing stations are included, in dependence on the condition factor $K$ for each individual fish as described above.

According to a still further aspect of the invention, the invention relates to a method and/or a system of processing of food items, in particular fish, whereby the food items are delivered to at least two processing stations for processing of food items, whereby

- a condition factor $K$ for a food item is provided utilizing measuring or detecting means, and whereby
- said food item is delivered to a selected processing station in dependence on said condition factor $K$.

In a particular aspect of the invention the method and/or the system is used for processing of salmon.

As mentioned above, the invention is in particular related to the processing of fish, but it will be apparent that the invention may also find use in connection with a wide variety of items, for example when processing foodstuff items, meat items, etc.
The figures
The invention will be further described in the following with reference to the
drawing, wherein

5 figs. Ia - Ic show systems according to embodiments of the invention for
processing of food items and in particular fish as seen in a schematic
view,

fig. 2 illustrates various length dimensions that may be used for a item such
as a fish in connection with the invention, and

10 fig. 3 illustrates various methods and tools that may be utilized when
determining or estimating the condition factor K according to the
invention.

Detailed description

15 A system 1 for processing of fish according to an embodiment of the invention is
shown in fig. Ia in a schematic view. Here, a number of processing stations 2 are
shown, which processing stations 2 for example may be gutting machines, filleting
machines or other types of machines for processing of fish. As shown, the fish 10
may be transported to the processing stations 2 by means of conveyors 6. Further, the
system 1 may comprise one or more manual processing stations 4, where an operator
8 can perform a manual processing, e.g. gutting, filleting, slicing, etc. of fish 10.
However, it is noted that the system may comprise only processing stations 2, which
comprises machines for performing the operations, e.g. automated processing
stations. An example of such a system is shown in fig. Ic.

20 The fish 10 can be supplied to the system by means of a feeding conveyor 12 as
shown. Here, measuring or detecting means 20 and 22 may be placed for measuring,
detecting and/or estimating various characteristics of the fish 10 passing these means,
in particular the weight of each fish and a length dimension of each fish, preferably
the length of each fish understood as the length from nose to tail. But it will be
understood that other length dimensions which are indicative of the length of the fish
can be used, for example the length along the upper part of the fish from nose to tail if found expedient. As shown, a measuring or detecting means 20 may be configured for measuring, detecting or estimating the weight W of each fish and a further measuring or detecting means 22 may be configured for measuring, detecting or estimating the length dimension L of each fish passing on the feeding conveyor 12. It will be understood that various measuring or detecting principles and means may be used in connection with the above-mentioned measuring or detecting means 20 and 22, which will be apparent to a skilled person within the field. For example, a dynamic weighing machine may be used for measuring the weight W or a vision system, scanning means, etc. may be used for estimating the weight or a value corresponding to the weight W. Further, it will be apparent that the length dimension L can be measured, detected or estimated by mechanical measuring means, by means of radiation means, scanning means, a vision system, etc. Also, it will be apparent that if for example a vision system, scanning means, or the like is used, such a system or such means can provide data for the length dimension L as well as the weight or a value corresponding to the weight W, e.g. for example by providing a volume measurement of each fish and calculating or estimating the weight W by means of a specific mass factor. Further, it is noted that further characteristics can be provided by the measuring or detecting means 20 and 22, for example the position and/or orientation of the fish 10 on the feeding conveyor 12.

As also indicated in fig. 1a, even further measuring or detection means 38 such as equipment for providing data regarding material composition, density and/or density variations of the items may be used in addition to the measuring or detecting means 20 and 22. Such further equipment may be equipment providing X-ray measurements, nuclear magnetic resonance (NMR, MR) measurements, etc. Such further equipment may also be used in connection with the embodiments shown in figs. 1b and 1c.

The data provided by the measuring or detecting means 20 and 22 can be supplied to for example a control unit 26, which may be configured for supplying control signals
to for example diverter means 28 or the like, which are schematically shown in fig. Ia for delivering fish selectively to the processing stations 2 or 4. Such diverter means 28 or the like may be diverter wings, controllable chutes, manipulators, robotic arrangements or the like, which will be apparent to a skilled person within the field.

The supplied fish 10, even though they preferably may be of the same specie, may differ in length and weight as well as in other regards. Further, it is noted that even though two fish may have the same length, they may differ in weight and vice versa. For example, two fish, for example two salmons may both have a weight of 5 kg, but one is 700mm long whereas the other one is 750mm long, e.g. depending on how fat or thin the fish is.

In order to optimize the processing of such fish, e.g. by having processing stations 2 that are specifically optimized for processing of fish within predefined ranges and by possibly having one or more manual processing stations 4, where fish that cannot be processed at an automated processing station 2 or at least not in an expedient manner, can be processed, the system 1 is configured for selectively directing the supplied fish to a specific processing station 2 or 4 in dependence on a condition factor $K$ that may be calculated by the control unit 26 and which is based on the length dimension $L$ as well as the weight $W$ of the fish.

The selective directing of the supplied fish may comprise that
- a fish is directed either to one unspecified of the automated processing stations 2 or to a manual processing station 4 or it may comprise that
- the fish is directed to one specified automated processing station 2, for example if the automated processing stations 2 are optimized for handling specific ranges, or to a manual processing station 4.

Also, as mentioned above and as shown in fig. Ic, the system 1 may comprise only automated processing stations 2, in which case the selective directing of the supplied
fish may comprise that a fish is directed to one specified automated processing station 2 selected among the processing stations 2.

Furthermore, as shown in fig 1b, a system according to the invention may comprise only two processing stations, i.e. one automated processing station 2 and one manual processing station 4, which is operated in general as explained above. In this connection it is noted that the embodiments shown in figs. 1b and 1c may be configured in general along the same lines as explained in connection with the embodiment shown in fig. 1a and utilizing similar equipment and means.

The condition factor K is as mentioned above based on the length dimension L as well as the weight W of the fish, whereby the condition factor will be indicative of not only the size of the fish, but also the general condition of the fish. Hereby, a fish that is abnormal, such as a short tail fish or an extra thin and long fish can be directed into a manual processing station 4, e.g. a manual gutting station. Also, the processing stations, e.g. the gutting machines can be optimized in a better manner if fish with similar condition are graded into the machines.

The condition factor will thus be a function f(L,W) of the length dimension L as well as the weight W of the fish and may be calculated as a ratio between a first parameter P1, which is based on the measured or estimated weight W, for example a value delivered by the measuring or detecting means 20, which is proportional to the actual weight W, and a second parameter P2, which is based on the measured or estimated length dimension L, for example a value delivered by the measuring or detecting means 22, which may be proportional to the actual length L or at least indicative of the length L. Thus, it will be understood that the parameters P1 and P2 may be functions of the weight W and the length dimension L, respectively.

Furthermore, the condition factor K may be calculated as P1 divided by \((P2)^N\), where N may be a selected from a range of numbers, but where N preferably is 3. Hereby, the K factor may be calculated as \(K = \text{Weight}/\text{Length}^3\), whereby it is an indicator of
how fat or thin the fish is, corresponding to the K factor used for estimating the condition of live fish.

As an example it can be mentioned that according to an embodiment of the invention the normal range of the K factor may be from 0.80 to 1.60 and if a manual processing station 4 is included in a system, all fish having a K factor outside of this range can be directed to the manual processing station 4. As regards the automated processing stations 2, fish within the range 0.80 to 1.00 may for example be directed to the first processing station 2, fish within the range 1.00 to 1.20 may for example be directed to the second processing station 2, fish within the range 1.20 to 1.40 may for example be directed to the third and the fourth processing station 2 (for example because most of the fish in the particular batch are within this range), and fish within the range 1.40 to 1.60 may for example be directed to the fifth processing station 2. It will be apparent that the ranges may overlap and that further the ranges may be dynamically changed in order to achieve that all processing stations are working continuously, i.e. no stations will be idle, controlled for example by the control unit 26. Also, it will be apparent that a fish that due to its K factor should be directed to e.g. the third processing station, can be directed by the control unit 26 to the second processing station (or to the manual processing station 4), if this is idle, in order to optimize the processing speed and the efficient use of the machinery. Further, it will be understood that if a manual processing station 4 is not included in the system, fish having a lower K factor than 0.80 may be directed to e.g. the first processing station 2 and fish having a higher K factor than 1.60 may be directed to e.g. the fifth processing station 2. Other variations are possible as well, which will be apparent to a skilled person.

As indicated in figs. 1a - 1c, the processing stations 2 may be followed by further processing stations 32, to which the fish are delivered by further conveyors 36 (shown only for one of the processing stations 2). Such a further processing station 32 may for example be a filleting machine in case the first processing station 2 is a gutting machine. Further, it is shown in figs. 1a - 1c that the fish or products
herefrom may be transported by a product conveyor 40 to further processing, quality control, packaging, freezing, etc. which will be apparent to a skilled person within the field.

As mentioned above, various length dimensions L, which are indicative of the length of an item such as a fish can be used in connection with the invention. This is further illustrated in fig. 2, wherein various length dimensions L1, L2 and L3 are indicated in connection with a fish 10. As mentioned above, the length L1 from nose to tail of the fish may be used. Instead, for example the length L2 along the lower (or upper) part of the fish may possibly be used, if this is found expedient, for example in view of the measuring or detecting means used in the system. Also, the length L3 from the nose of the fish to the root of the tail may be used. It will be apparent that other length dimension that may not necessarily be measured along a straight line may be used as the characteristic length dimension in connection with the invention.

Furthermore, as illustrated in fig. 3, various methods, tools, etc. may be utilized when determining or estimating the condition factor K according to the invention. Here, the control unit 26 is shown, comprising processing means 41, e.g. calculating, estimating, determining means, etc. which provides the condition factor K as an output 46, based on input 42 and 44, corresponding to length and weight parameters, and possibly other input signals 48, for example input from further measuring or detection means 38 such as equipment for providing data regarding material composition, density and/or density variations.

The condition factor K may be provided utilizing an equation 50, e.g. the equation \( K = \frac{\text{Weight}}{\text{Length}} \).

Furthermore, an approximation 52 to a specific equation may be utilized.

For example, when the equation \( K = \frac{W}{L^N} \) is concerned, the approximated equation
\[ K = \frac{W}{a - bL} \]

may be used, where \( a \) and \( b \) are arbitrary constants.

This equation may hold for a limited range of weight and length values.

For very narrow ranges of weight and length variation the relationship between weight and length may be a simple linear relationship, resulting in:

\[ K = \frac{W}{a + L} \]

where \( a \) is an arbitrary constant.

Similarly, other mathematical expressions may be utilized as approximations or in place of equation \( K = W / L^N \).

Further, the condition factor \( K \) may be provided utilizing a lookup table 54. Here, the condition factor can be determined from table values of weight, length, or other measured properties. If specific measurements are not found in the table, a method of interpolation may be used to determine the condition factor.

Also, other computerized means such as a neural network 56, i.e. an artificial neural network, where the condition factor \( K \) is determined from the measured properties of the fish, or a fuzzy logic system 58, where the condition factor \( K \) is determined from the measured properties of the fish, may be utilized.

It will be apparent to a skilled person that other means and methods 60 can be used.

In the foregoing, various embodiments of the invention have been described with reference to the drawing, but it is apparent for a person skilled in the art that the invention can be carried out in an infinite number of ways and within a wide range of variations within the scope of the appended claims.
List of references

1  System for processing of fish
2  Processing station
5 4  Manual processing station
6  Conveyor for processing station
8  Operator
10  Fish
12  Feeding conveyor
10 20  Measuring or detecting means
22  Further measuring or detecting means
26  Control unit
28  Diverter or the like
32  Further processing station
15 36  Further conveyor
38  Further measuring or detecting equipment
40  Product conveyor
41  Processing means
42  Input - length parameter
20 44  Input - weight parameter
46  Output - condition factor
48  Input - further equipment
50  Equation
52  Approximation to an equation
25 54  Lookup table
56  Neural network
58  Fuzzy logic
60  Other
Patent claims

1. System for processing of food items wherein said system comprises at least two processing stations (2) for processing of said food items, wherein said system further comprises
   - measuring or detecting means for determining or estimating a length dimension L and weight or a value corresponding to the weight W of individual food items,
   - means for providing a condition factor K for individual food items based on said determined or estimated values for the length dimension L and weight or a value corresponding to the weight W of said individual food items, and
   - means for delivering an individual food item to a selected processing station (2) in dependence on said condition factor K for said individual food item.

2. System according to claim 1, wherein said food items are fish (10) and wherein said at least two processing stations (2) for processing of said food items may be for example gutting or filleting machines for processing offish (10).

3. System according to claim 1 or 2, wherein said means for providing a condition factor K based on said determined or estimated values involves use of an equation for determining the factor K, possibly in approximated form.

4. System according to claim 1 or 2, wherein said means for providing a condition factor K based on said determined or estimated values involves use of a lookup table.

5. System according to claim 1 or 2, wherein said means for providing a condition factor K based on said determined or estimated values involves use of an artificial neural network and/or a fuzzy logic system.

6. System according to any of claims 1 to 5, wherein said means for providing a condition factor K based on said determined or estimated values involves further measuring or detection means such as equipment for providing data regarding
material composition, density and/or density variations of the items, which equipment may provide X-ray measurements, nuclear magnetic resonance (NMR, MR) measurements, etc.

7. System according to any of claims 1 to 6, wherein said condition factor K involves a ratio between a first parameter P1 based on the weight or a value corresponding to the weight W of the item and a second parameter P2 based on the length dimension L of the item or wherein the condition factor K involves the reciprocal value of said ratio.

8. System according to claim 7, wherein said condition factor K is defined as \( P1/(P2)^N \) or as the reciprocal value of this ratio.

9. System according to claim 8, wherein \( 2 \leq N \leq 4 \).

10. System according to claim 8, wherein \( N = 3 \).

11. System according to any of claims 7 to 10, wherein said first parameter P1 is equal to the weight or a value corresponding to the weight W of the item and said second parameter P2 is equal to the length dimension L of the item.

12. System according to any of claims 1 - 11, wherein one of said at least two processing stations is a manual processing station (4), e.g. for manual gutting or filleting offish (10).

13. Method of processing of food items, whereby the items are delivered to at least two processing stations (2) for processing of said food items, whereby - data relating to a length dimension L and weight or a value corresponding to the weight W of a food item is provided by measuring or detecting means,
- a condition factor $K$ is provided for said food item, based on said data relating to the length dimension $L$ and weight or a value corresponding to the weight $W$ of the food item, and whereby
- said food item is delivered to a selected processing station (2) in dependence on said condition factor $K$.

14. Method according to claim 13, wherein said food items are fish (10) and wherein said at least two processing stations (2) for processing of said food items may be for example gutting or filleting machines for processing offish (10).

15. Method according to claim 13 or 14, whereby said condition factor $K$ is provided by use of an equation for determining the factor $K$, possibly in approximated form.

16. Method according to claim 13 or 14, whereby said condition factor $K$ is provided by a process involving use of a lookup table.

17. Method according to claim 13 or 14, whereby said condition factor $K$ is provided by a process involving use of an artificial neural network and/or a fuzzy logic system.

18. Method according to any of claims 13 to 17, whereby said means for providing a condition factor $K$ based on said determined or estimated values involves further measuring or detection means such as equipment for providing data regarding material composition, density and/or density variations of the items, which equipment may provide X-ray measurements, nuclear magnetic resonance (NMR, MR) measurements, etc.

19. Method according to any of claims 13 to 18, whereby said condition factor $K$ involves a ratio between a first parameter $P_1$ based on the weight or a value corresponding to the weight $W$ of the item and a second parameter $P_2$ based on the
length dimension L of the item or whereby the condition factor K involves the reciprocal value of said ratio.

20. Method according to claim 19, whereby said condition factor K is defined as \( P_1/(P_2)^N \) or as the reciprocal value of this ratio.

21. Method according to claim 20, wherein \( 2 \leq N \leq 4 \).

22. Method according to claim 20, wherein \( N = 3 \).

23. Method according to any of claims 19 to 22, whereby said first parameter \( P_1 \) is equal to the weight or a value corresponding to the weight \( W \) of the item and said second parameter \( P_2 \) is equal to the length dimension \( L \) of the item.

24. Method according to any of claims 13 to 23, whereby one of said at least two processing stations is a manual processing station (4), e.g. for manual gutting or filleting offish (10), and whereby in dependence on said condition factor K said food item is delivered to said manual processing station (4).
A. CLASSIFICATION OF SUBJECT MATTER

INV. A22C25/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A01K A22C B07C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>WO 01/72613 Al (SIGTRYGGSSON THRAINN [IS]) 4 October 2001 (2001-10-04) * abstract; claims 1-9; figures 1-6 page 1, line 5 - page 7, line 14</td>
<td>1-24</td>
</tr>
<tr>
<td>Y</td>
<td>CHARLES BARNHAM; ALAN BAXTER: &quot;Condition Factor, K, for Salmonid Fish&quot; FISHERIES NOTES, no. FN0005, March 1998 (1998-03), pages 1-3, XP007915112 Melbourne, VIC, Australia ISSN: 1440-2254 the whole document</td>
<td>1-24</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C

See patent family annex

Date of the actual completion of the international search

30 September 2010

Date of mailing of the international search report

07/10/2010

Name and mailing address of the ISA/
European Patent Office, P B 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel (+31-70) 340-2040, Fax (+31-70) 340-3016

Authorized officer
Rojo Galindo, Angel
### DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ES 2 289 940 A1 (CONSEJO SUPERIOR INVESTIGACION [ES]) 1 February 2008 (2008-02-01)</td>
<td>1-24</td>
</tr>
<tr>
<td></td>
<td>* abstract; claims 1-5; figures 1-5 page 2, line 5 - page 6, line 66; examples 1-3</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>JP 8 050052 A (YAMATO SCALE CO LTD) 20 February 1996 (1996-02-20) cited in the application</td>
<td>1-24</td>
</tr>
<tr>
<td></td>
<td>* abstract; figures 1-8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* abstract; claims 1-37; figures 1-11 column 2, line 15 - column 3, line 34</td>
<td></td>
</tr>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
<td>Patent family member(s)</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>-----------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>WO 0172613</td>
<td>04-10-2001</td>
<td>AU 3953701 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1284912 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IS 5421 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NO 20024669 A</td>
</tr>
<tr>
<td>ES 2289940</td>
<td>01-02-2008</td>
<td>WO 2008009773 A1</td>
</tr>
<tr>
<td>JP 8050052</td>
<td>20-02-1996</td>
<td>NONE</td>
</tr>
<tr>
<td>US 4868951</td>
<td>26-09-1989</td>
<td>NONE</td>
</tr>
</tbody>
</table>