REPORT OF THE

STUDY GROUP ON BALTIC COD AGE READING

Rostock, Germany
7–11 October 1996

International Council for the Exploration of the Sea
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1 TERMS OF REFERENCE

At the 83rd Statutory Meeting it was resolved (C.Res.1995/2:42) that the "Study Group on Baltic Cod Age-Reading" would be held in Rostock, Germany from 17–21 June 1996 under the Co-Chairmanship of Dr J. Netzel (Poland) and Dr P. Ernst (Germany) to:

a) establish a reference collection of otoliths from different sub-divisions, seasons and length groups of cod to reach a common interpretation of otolith structures;

b) set up standards for the technical methodology in the age reading procedure as part of a manual on age-reading of cod otoliths.

Since it is unlikely that the otolith exchange material needed will be available in time for the meeting of this Study Group in June 1996, it has been decided that it should be postponed to 7–11 October 1996.

2 PARTICIPANTS

The meeting was attended by the following persons:

O. Bagge	Denmark
T. Baranova	Latvia
A. Bratt	Sweden
T. Drevs	Estonia
P. Ernst (Co-Chairman)	Germany
D. Fey	Poland
J. Gröger	Germany
R. Hoffmann	Germany
H. Mosegaard	Denmark
J. Netzel (Co-Chairman)	Poland
M. Plikshs	Latvia
F.D. Poulsen	Denmark
N. Schulz	Germany
G. Ulrich	Germany
Y. Walter	Sweden

3 STANDARDIZATION OF OTOLITH AGE READING METHODOLOGY

3.1 Standard Method of Age Reading of Baltic Cod

3.1.1 Methods used in different countries

Denmark

The Danish readers of Baltic cod otoliths always use broken otoliths. To cut the otoliths some readers use a small wire cutter designed to cut piano wire. If the otolith is not broken through the center we use an electric grinding machine to grind it carefully to the center of the otolith. The grinding stone is partly in water and turns with a speed of 150 rounds per minute.

Each reader uses a binocular microscope with a magnification from 5 to 20, usually 6 to 12.

Most of the readers have set up 2 microscope lamps so that they can change between transmitted and reflected light. The direction of the microscope light is a personal matter, but the readers can manage both methods.

Normally each reader uses a pair of tweezers to hold the otolith part which is grinded to the center. To hold it in the hand gives the reader the opportunity to turn and twist it to make sure that it is in the right focus plane. Also, it gives the reader a good possibility to make experiments with the light using the free hand to make shadows with a pencil or something else.

The otolith is read while it is dipped down into a cup with water or alcohol.

More or less the Danish readers prefer to place the microscope in the darkest place of their offices to leave out unwanted sunlight or disturbing electrical room lighting.

In which direction the single reader prefer to read the otolith is a personal preference, too. There are readers who read from the center to the dorsal end; others do it from the center to the ventral end; but in many cases it gives a good result to read it along a line from the center to the edge somewhere between sulcus acusticus and the ventral end or somewhere between sulcus acusticus and the dorsal end.

In general each otolith is read in more than one direction to make sure that the interpretation is as good as possible.

Interpretation of cod from Sub-division 22

If you have an otolith from a young/small cod caught in the winter period until early spring, you are often in the situation where you can see an opaque zone on the edge of the otolith. In the winter, November–January it is thin, but later on it gets thicker. There is absolutely no hyaline/translucent zone on the edge as expected for this area.

This opaque zone is belonging to the just started growth period. It is therefore not expected that a winter ring is found on the edge. The WR seen a little bit from the edge is belonging to the winter just passed. See otolith no 2 and 3 in the reference sample.

By experience when getting older cod (from the northern part of Sub-division 22) creates increments of opaque or hyaline/translucent zones in correspondence to the human seasons of summer and winter.

Estonia, Germany, Latvia and Poland

Sampling of cod sagittal otoliths is carried out in harbours/markets and during cod surveys. The otoliths are put into envelops (dry) with data on the biological standard parameters length, weight, maturity etc. In the laboratory (lab. of research vessel or Institute) the otoliths are broken through the center of the nucleus. The broken otoliths are read by aid of a binocular microscope in reflected light and focused on the broken surface of the otolith in a solution of ethanol, water or mixture of alcohol, water and soap. Otoliths that are difficult to read are cut into slices (0,2–0,50 mm). These slices are read in transmitted light without the described solution (see above). Some reading experiments have been conducted with broken and burned otoliths. The broken otoliths are burned on an electric heating plate until receiving a light brown colour.

In Germany and Poland the standard procedure of preparation is breaking unburned otoliths whereas in Latvia otoliths are broken and burned before reading.

Sweden

In Sweden cod otolith reading is made with broken otoliths using transmitted light.

The breaking of the otolith is always done through the nucleus. A small structure can be found on the convex side of the otolith indicating that position where the otolith should be broken. It is usually necessary to mark the centre of big otoliths before breaking them.

Usually the otolith-halves are placed vertically in wax or clay, but the reader may also hold it by a forceps under the microscope. When reading the broken surface it is always kept wet with water.

The direction of the microscope light depends on the preference of the reader. When reading, the otolith surface is shadowed by a pencil or a forceps. The magnification used is usually low (6.3 * 1.6 or 10 * 1.2) , i.e. the otolith length is less than half the view-field in the microscope.

3.1.2 Equipment and techniques used during the workshop

During the workshop mainly stereomicroscopes (Olympus) were used for viewing the otoliths. The most used magnification was 6.3 * 1.6.

Broken otoliths (untreated, burned, partly polished).

Binoculars such as from Zeiss, Olympus, Technival were set up with various filters and high quality phase objectives. The stereomicroscopes give a three-dimensional image of the otoliths.

Illumination methods were found to be very critical. Reflected light was used when examining the otoliths. Gooseneck fiber optic illuminators and free-standing/free-hanging lamps appear to be the best light sources. The visibility of otolith growth patterns also enhanced by applying various wetting agents, such as alcohol, water, soap-water.

The broken otolith halves were either hand-held under the microscope or were temporarily mounted on a piece of soft black plasticine and then immersed in the wetting agent for viewing.

The ring patterns of the broken otolith surface may be further elucidated by focusing the microscope and/or simply shading the reflected light by a stick, pencil, etc.

Otolith slices

The technique to produce otolith slices were demonstrated.

Slices of selected otoliths were produced by a two-diamond-blades-saw. Cutting speed, water flow (if possible) and height of the blade (blades distances from 0.5 to 0.8 mm) were adjusted before sectioning. Preparation of the otoliths before sectioning was as follows:

1. Otoliths were embedded in an epoxide casting resin (if the epoxide is coloured, for instance black, the contrasts in the slices are improved).

2. The otoliths were cut through the nucleus, giving 0.5 to 0.8 mm slices embedded in epoxide.

3. The slices were fixed between two glass plates for viewing.

When viewing the slices either reflected or transmitted light was used. Polarizing filters were not used during this workshop, even if they could be used to reduce glare or to improve the contrast.

3.1.3 Applications of the daily increments analysis

The daily increments, found in otoliths of larval and juvenile fish allow to estimate the age of the fish. Once the age is known different parameters may be calculated: hatching time of the fish, it's growth rate etc. In the case of adult cod age analysis there are some difficulties associated with the interpretation of the first and last hyaline zone. Thus, it would be very useful if we can estimate the time of the hyaline zone (so called "winter ring") formation. There may be some differences related to the area of sample collection (eastern-western Baltic), as well as to the time of hatching of a given specimen (spring, summer or autumn spawning). Since there is information about shift of the peak of cod spawning time towards the second half of the year (results presented at the meeting) it seems to be especially important to investigate the growth of otoliths during the first six to ten months of fish life. This way also the influence of transition from the pelagic style of life to a bottom one on the otolith structure would be investigated, this would be helpful as far as the interpretation of the "metamorphosis ring" and the "juvenile ring" is concerned. If only analysis of up to 300 daily increments on the otolith is possible, calendar date of hyaline zones formation should be back-calculated. Such an analysis would provide important information improving understanding of otolith structure formation and make adult cod ageing more accurate.

3.2 Terminology for Ageing

3.2.1 Terminology

Age determination: It is the process of fish age reading to register structures (scale, sagitta) which reveal cyclic changes in fish growth.

Age group: The group of fish that has a given age (e.g. the 2-year-old age-group, 4-year-old-age-group). The term is not synonymous with year-class. The change of age group is settled at the 1st of January.

Annual growth zone: one opaque and one hyaline zone constitute a typical growth zone.

Checks: Narrow hyaline zone that forms within the opaque zone. These zones should not be included in the age estimation. More than one check per year may be formed, especially in the first opaque growth zone.

Edge of otolith (zone at the edge of otolith): Opaque or hyaline (narrow or wide) zone on the edge of otolith. The amount and type of growth on the edge is related to the life cycle of the fish.

Hyaline (translucent) zone: A growth zone that allows a better passage of light. On the surface of broken otoliths and slices under reflected light, the hyaline zone appears dark, in transmitted light it appears bright (light).

Juvenile zone: It is a one or several narrow hyaline zones surrounding the center of the otolith, it is supposed to be formed at settling but it is not found in all otoliths.

Metamorphic ring: phrase should be avoided, but usually referring to an almost circular hyaline zone surrounding the otolith center, approximately at the initiation of the secondary primordia.

Otolith center: It is the central area of the cod otolith boundered by the metamorphic ring. The center is formed during the larval stage. It is always hyaline provided a sectioning through the nucleus.

Opaque zone: A growth zone that restricts the passage of light. On the surface of broken otoliths and slices under reflected light the opaque zone appears white, under transmitted light it appears dark. The opaque zones on otoliths of cod in the Eastern Baltic are formed in the period of intensive feeding.

Reflected light: Light that is directed towards and reflected from the sectioned surface of an otolith, either from above or from the side if the surface, is not shadowed.

Sagitta: In juvenile and adult cod the largest of the three pairs of otoliths found in the membranous labyrinth. It is elongated trapezeform with a lobed edge. It consists mainly of calcium carbonate that will dissolved in acid fluids, e.g. formalin. Cod sagitta has a "two-layer" structure.

Secondary primordia: Growth centers initiating the first formation of lobes, forming after the termination of the larval period.

Settling (juvenile) ring: see juvenile zone.

Sulcus acousticus: The groove passes on the inner surface of an otolith with a bend under the otolith center.

Transmitted light: Light that passes through the otolith, or from the side of a broken otolith if the surface is shadowed.

Year class: A cohort of fish defined to be born in the same calendar year (1 January–31 December) e.g. 1995 year class.

Zone: Circum central region of similar structure and optical density on the otolith (hyaline, opaque).

3.2.2 Description of age determination procedures

The purpose of fish age reading is basically the determination of a generation or fish age group. The method takes into account peculiarities of otolith zone formation. The difficulty of age reading of eastern Baltic cod otoliths lies in the fact that the annual zone (one opaque and one hyaline zone) is not formed during one calendar year. In the first year of fish life (the year of generation birth) before the end of December otoliths show that the first incomplete opaque zone continues to form in the next year (after January 1.).A hyaline zone is formed mainly in April–August. The annual zone is fully formed mainly to the middle of the next (after birth) year of fish life. In a similar way annual zones are formed also on adult cod otoliths. Therefore to determine a generation

after the first of January (January–June) one year is added. In the first half of a year an opaque zone on the otolith edge is considered as an incomplete growth zone of the previous year. In the second half of a year an opaque zone is regarded as a new increment (plus growth) of that year.

The formation of zones on young fish otoliths

Settling of young cod on the bottom in the eastern Baltic occurs in late autumn or in winter. In research catches by bottom trawls young cod is found from December till April-May, the minimum length of young fish is 5 cm. The length of the modal group is 7–10 cm in December and 10–15 cm in March-April. A nucleus with a metamorphic or juvenile ring and an opaque growth zone is clearly seen in this period (March/April). A hyaline zone is formed in April-August. Schematically the formation of zones in otoliths of young cod and the corresponding age designation is the following:

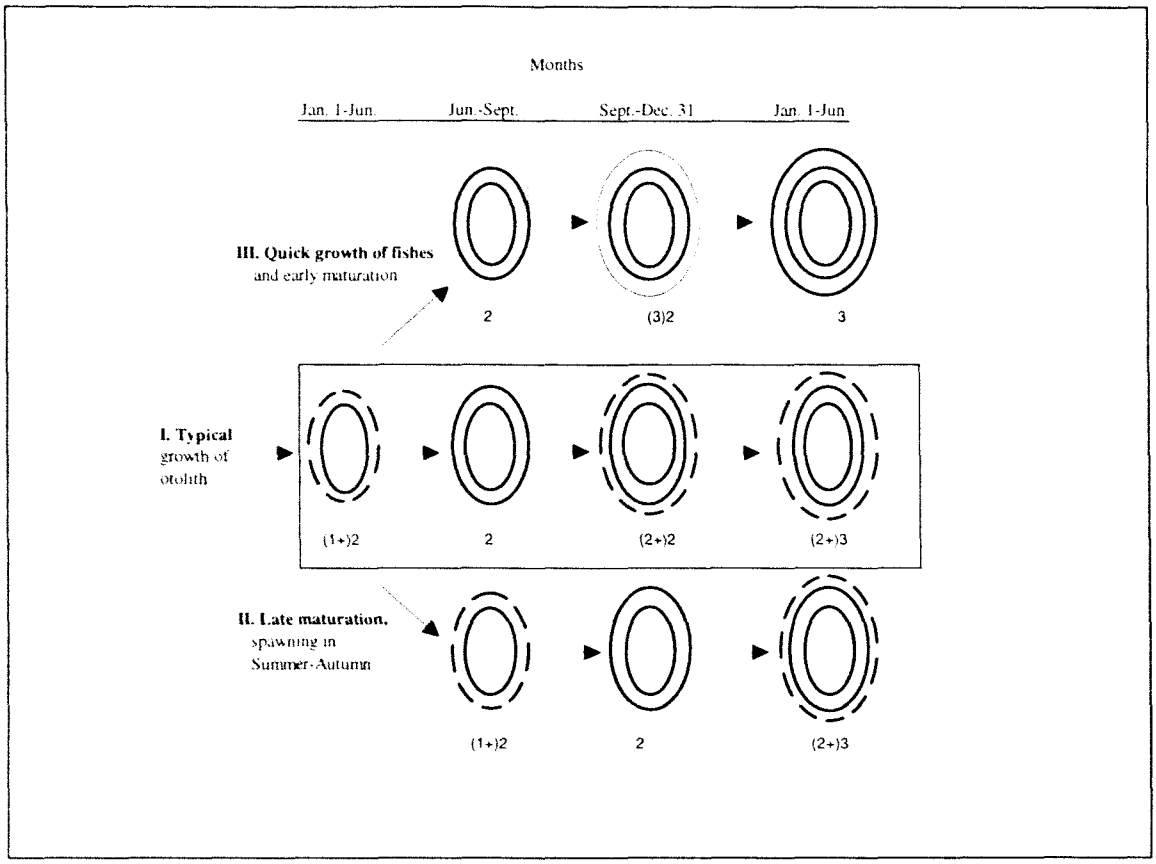
	Month	Otolith zone	Designation	Age
Year of generation birth	XII	one opaque	0+	0
The next year	I-IV	one opaque	0+)1	1
	V-VI	one opaque + one hyaline	1	1
	VII-XII	one annual zone (one opaque + one hyaline) + opaque growth zone at the edge of otolith	1+	1

In such way zones are formed in cod otoliths until cod becomes adult (it usually happens at age 2–3). The hyaline zone in young fish otoliths is formed earlier than it is in older fishes and is completed in a shorter time (Tokareva, 1963).

The formation of zones on otoliths of adult cod

An opaque zone in otoliths of eastern Baltic cod is formed during their intensive growth (September-March). A hyaline zone is formed at slowing fish somatic growth in spring-summer (April-August-September). The formation of a hyaline zone in ripening fish during their spawning is related to an intensive accumulation of calcium in otoliths at tissue liquid hypercalciumia (Krivobok *et al.*, 1976). Adult fish hyaline zone is formed in shorter time than that of unripening fishes. In recent years (1992–1995), due to late spawning, there has been a shift in the formation of the hyaline zone to later in the year (summer-autumn).

The scheme of zones formation in cod otoliths during the year is following:



Three variants are presented: the first variant is the most typical; the second one has been observed in recent years at late spawning when the formation of a hyaline zone is shifted to later in the year (summer-autumn) and the third variant is denoted by early cod ripening when a hyaline zone appears already in December, i.e. in the previous year.

These figures schematically represent otolith growth stages from January 1 to December 31. The black zones are hyaline zones: the wide black zones are complete zones and the narrow black zone is the incomplete hyaline zone. The dashed lines represent an incomplete opaque growth zone. The number in the brackets indicates the number of annual zones actually seen as well as the opaque growth that is represented by a "+". The number after the brackets is the age class interpreted according to the time of the year when the fish was caught. January 1 is considered to be the date of fish birth.

3.3 Methodology and Results of the Otolith Exchange Program in Preparation of the Meeting

In preparation of the exchange program a group of specialists (including the Co-Chairmen) discussed the composition of the otolith collection for the exchange program and suggested the following criteria:

Area

In order to obtain a proper coverage of the cod stocks otoliths should be sampled for each of the Sub-divisions 21–30. The otoliths to be included in the control collection will be combined to cover larger areas, e.g. Kattegat and Belt Seas, western and eastern Baltic depending on the outcome of studies of otolith growth patterns and characteristics. Each laboratory should obtain otoliths from each of he Subdivisions with significant national fishing effort. The final collection should not include more than 50 otoliths per area and year. The Sub-divisions that should be covered and the countries involved per area are according to the project outline:

Sub-divisions	Main countries involved in fishing
21	DK + S
22	DK + D (divided into north and south)
23	S, DK
24	DK + D + S
25	DK + -S + -D + PL
26	PL + (RUS) + LV + S (divided into Gotland and Gdansk)
27	S
28	S, LV
29–30+32	S + (FIN), EST

Seasons and years

The seasons of the year should be covered by quarter. In each Sub-division it is important to adjust (and log) the timing of collection with the spawning time and to log the condition of the cod. Periods to be dealt with are the pre-spawning, spawning and feeding periods. The years to be covered were discussed. In order to obtain material which could be for the ICES "Workshop on Baltic Cod Age Reading" in October 1996 it was necessary to obtain otoliths from 1995.

Size of fish

Each active country (see above) should collect one pair of otoliths per 5 cm length class in all about 20 pairs per Sub-division per season and area. The collection will not be sex specific, but the sex and sexual maturity of the fish should be registered.

Description of otoliths

To make the study and selection of the otoliths easier a short description of each otolith and the individual it originated from should be formulated by the sampler including information on length of fish, sex, location of catch, season, year, country and structural characteristics, etc. based on "Codes for the Age Reading Form" (see Appendix 2).

Organization of sampling

To organize the sampling within areas and sub-divisions and to reduce the number of otoliths to represent an area 4 area-coordinators are suggested. The co-chairman will coordinate the work among area-coordinators and be the responsible for the results of the work in this section. The combination of Sub-divisions and area-coordinators were suggested according to the primary national fishing areas. The following suggestion were made:

ICES subdivisions	Area coordinator
21 + 25	Henrik Mosegaard
22 + 24	Peter Ernst
23 + 27 + 29 + 30 + 32	Yvonne Walther
26 + 28	Tatjana Baranova and Maris Plikshs

It was fixed, that each country should send their selected otoliths and the descriptions to the area-coordinator not later than 15 January. The area-coordinators should then select 30–40 otoliths and establish an otolith exchange program for each of the ICES Sub-divisions they are responsible for. The otoliths should be representative for the seasons and size group as well as for the area, i.e. emphasis should be on the characteristic otoliths, but also unusual otoliths should be represented. The reduced collection and the result of the exchange program should be presented at the workshop in Rostock, 1996. The area coordinators should report regularly to the co-chairman who will coordinate the activities between areas.

The results of ageing were kept for further analyses in the developed standard ageing protocol "Form for Age Reading Analyses" (see Appendix 1)

3.3.1 Organization of the exchange program

SD 22+24

The area coordinator for the ICES-SD 22+24 selected an otolith collection for the exchange program composed of basic material of Sweden and Germany (34 otoliths of SD 22, 49 otoliths of SD 24). Otoliths from the Danish institute were not available for this exchange collection.

The exchange programme started in February 1996. Following institutes/labs were involved in the exchange programme for age reading of cod from the SD 22+24

- Institute for Baltic Sea Fishery, Rostock, Germany
- Baltic Sea Research Station, Karlskrona, Sweden
- Institute of Marine Research, Lysekil, Sweden
- Danish Institute for Fishery Research, Charlottenlund, Denmark

The collections were circulated among Institutes together with the protocol "Form for Age Reading Analyses", the "Codes for Age Reading", and a circular letter (see Appendix 3) describing how to handle the exchange material and the order for passing on the material to the next reader or institute.

The results of all involved institutes/labs of Sweden, Denmark and Germany were available for further investigations before the study group meeting started.

SD 21+25

For SD 21 otoliths for selection of a reference collection were supplied by the Swedish, the German and the Danish institutes.

60 cod otoliths covering all four quarters and all 5 cm length classes from 5 to 90 cm were selected as a reference collection from SD 21 for 1995. They were shipped from the Danish Institute 30. August 1996, to be circulated in an exchange programme among the two Swedish institutes to finally be returned to the Danish Institute (see Appendix A1).

For SD 25 otoliths were supplied by the German, the Polish, the Swedish and the Danish institutes.

48 cod otoliths covering all four quarters and all 5 cm length classes from 15 to 100 cm were selected as a reference collection from this SD for 1995. They were shipped from the Danish Institute 9 September 1996, to be circulated in an exchange programme among the German, the Polish and the two Swedish institutes to finally be returned to the Danish Institute (see Appendix A1).

Further, paper copies of digitized images of each polished otolith section were sent out in duplicates to each institute involved in the specific exchange programme. The paper copy was intended, in connection with direct microscope observations, as a chart to mark out the exact positions of annual and other structures relevant for the age reading (see also Appendix A1).

SD 26 + 28

The collections of cod otoliths and age reading exchange programme were organized in LatFRI (Latvia).

Fish biological parameters, i.e. length, weight, sex, maturity stages (eight-point maturity scale), as well as otolith characteristics, i.e. weight, length, width are given for each otolith of the collection. The elements of the inner structure, i.e. nucleus, edge of an otolith, the character of zones are described using the codes elaborated earlier. The codes for description of otolith zones (point 6 Zones) are supplemented with 3 new ones:

V - not visible but expected,
A - not sharply outlined,
M - hyaline zone consisting of several narrow rings.

Otoliths were collected from 5 cm length groups ranging from 10 to 90 cm and were distributed according to the length groups for each quarter.

In SD 26, otoliths were received from Latvia (35 specimens), Poland (28 specimens), Sweden (42 specimens) and cover sampling in all 4 quarters. These collections were read by experts from Poland, Latvia and Sweden. The otoliths from Russia (60 specimens) were received shortly before the meeting. Therefore only Latvian, Polish and Russian specialists were able to age them.

In SD 28 otoliths were received from Sweden (45 specimens) and Latvia (22 specimens). These collections were aged by specialists from Latvia, Poland and Sweden.

Due to high migration rates of cod between Sub-divisions 25–29 these otolith collections should be read by specialists ageing cod from the total eastern Baltic stock (Sub-divisions 25–32).

Only samples from the neighbourhood of this Sub-division 28 were sent to the area co-ordinator (Latvian and Swedish samples). These samples were aged by Latvian, Polish and Russian readers.

The area co-ordinator selected the first area reference collection. The results of different readers show some disagreements, in some cases the results varied up to 3 years.

SD 23 + 27 + 29 + 30 + 32

In Sub-division 23 the exchange program was organized by Sweden and also involving Denmark in the compilation of otoliths.

Unfortunately Denmark was not able to supply any otoliths from surveys in 1995, but will if possible contribute to the collection with material from previous year's surveys.

After completion of the otolith collection the material will circulate between specialists in Sweden, Denmark and Germany, and finally the readings will be analysed statistically in Germany.

Sweden was the only country sampling cod in SD 27 in 1995, and consequently the material on which the future reference collection is based is supplied solemnly from Swedish surveys. If necessary, otoliths collected in commercial fisheries can be added to complete the collection, although this sampling will not provide information on the maturity stage of the cod.

At present the existing material consists of 33 otoliths from 1, 3 and 4 quarter in 1995 and is circulating between Sweden, Poland, Latvia and Estonia for interpretation by specialists. Upon completion of the circulation the results will be sent to Germany for statistical analysis.

In SD 29–32 the exchange program was organized by Sweden with additional help from Finland. Unfortunately hardly any sampling had taken place in 1995 since the importance of this area as a fishing ground for cod has decreased.

If possible, otoliths will instead be collected from previous year's surveys to establish a reference collection from this area. This collection will be circulated to specialists in Sweden, Finland, Latvia and Estonia, and finally the readings will be analysed statistically in Germany.

3.3.2 Statistical methods used

In general, the whole statistical analysis for the present workshop was carried out by Sub-division. At first, it was necessary to filter out "uncertain otoliths" from all otolith samples circulated between the different participating institutes in order to discuss the disagreement. Secondly, it was necessary to find a procedure by which the unknown true age could be approximated for modeling and comparison reasons. Thirdly, it was necessary to build individual calibration models for age correction purposes.

The detection of uncertain otoliths

In order to detect those otoliths of which a smaller agreement about its age existed, per each otolith a coefficient of variation (= CV; expressed as percentage) was calculated over the corresponding readings of all participating readers. In addition, different types of measures were computed to approximate the unknown actual age (i.e. modal age, median, rounded mean). Only otoliths of high agreement were said to be certain and directly put into the final (optimized) reference collection. High agreement was reached when the CV was below a small limit and when the measures did not vary between each other. This limit was discussed during the workshop. All other otoliths were discussed again during further reading comparisons under microscopes and binoculars by the participants of the workshop.

The detection of different national schools

The existence of different national schools was detected by means of ANOVAs combined with tests of linear contrasts (Bonferroni).

Identification of individual calibration models and age correction

Details of the theory necessary for understanding this and the following sections can be looked up in Gröger (1996a, b, c). In general, through calibration a "biased or uncertain" (random) target variable can be standardized by means of a calibration standard in order to extract the "most real" information content by eliminating the uncertainties or the bias. Inter alia, this is necessary when comparing different samples of the above target variable. In the current case the "uncertain or biased" target variable is "filled" with individual age readings. In order to get the most appropriate calibration standard it would be best to know the exact age of the corresponding otoliths.

Unfortunately as in most cases also in the current case the exact age of the target otoliths is unknown. Therefore, it is necessary to establish a concept by which the exact age of the corresponding otoliths can be approximated, i.e. by which a calibration standard can be set up under the condition of not knowing the exact age. This approximation of the calibration standard will be defined here as "true age". It can be any reliable estimation of the exact age which gave satisfactory results when analysing historical otolith data for which the exact age was known since no better (or perfect) information is given for the moment. The procedure of defining a suitable approximation can be the following. Per each otolith, the exact age could be defined, i.e. an appropriate calibration standard could be determined by calculating the truncated or rounded arithmetic mean, the mode or the median from the individual age readings of the corresponding readers or by calculating any other appropriate measure which shows (or showed in the past) a relatively good correspondence with the exact age. This estimation concept will be defined here as "true age concept".

Based on this "true age concept", for each participating reader an individual calibration model was calculated. The basic idea behind this is: in those cases where the corresponding readings are significantly biased by any systematic component (i.e. differ significantly from the defined calibration standard) this component is to be identified and eliminated. The resulting calibration model should then be able to "correct" the age reading results of the related reader by predicting the corresponding "true age". The practical procedure is: per each reader a linear relationship between "true age" (approximated by modal age, median or rounded mean) together with various exogenous co-variables (listed on the circulated form sheet) and read age (endogenous variable) was stated. Beside "true age" (and possibly a constant) only those co-variables were selected by a backward elimination algorithm which had been detected as significantly biasing the associated readings. The resulting regression model was inverted (i.e. solved with respect to "true age") and the corresponding "true age" was predicted. Beside various statistical tests the improvement or success of the correction was finally measured by comparing the total deviation of the readings from "true age" before and after the correction.

3.3.3 Results of the exchange program

Test results, figures and the fulfillment of related test prerequisites for Sub-divisions 22, 24, 26 and 28 can be inspected in more detail in the Numerical Output Section (item 7.). All variables used and their coding (if not of metric nature) can be looked up in the Appendix concerning the description of the form sheet.

SD 22

In SD 22, 8 readers were involved in the readings of the 34 otoliths in total. From their readings CVs, modal age, median age and rounded mean age were calculated for each otolith. Modal age was chosen as calibration standard ("true age"). The large number of 21 CVs with a value of 0% indicate a high agreement between readers (disagreement in 38% of the cases). This is confirmed by the fact that the remaining CVs moderately range between 7% and 36% and that mode, median and rounded mean only differ in three cases which marks a relatively high stability of these 3 true age indices. The latter also underlines the assumption that the observations are normal over the readers.

All otoliths from the circulated sample with a CV of 0% were taken immediately into the reference sample. Total agreement could only be reached between 6 readers of the 8 readers on 21 of the 34 otoliths.

This set of 21 otoliths was supplemented by two other cod otoliths caught in March. These two cod otoliths were seen to be typical for this Sub-division although there was some disagreement on how to interpret them.

The final reference sample ended up with 23 cod where not all of them were represented by 2 otoliths (the left and right one). In fact, for only 9 specimen two otoliths were present.

The length of cod covered sizes from 12 to 68 cm, ages from 1 to 4 covering all 4 quarters.

Taking into account the 34 individual readings of each of the 8 readers and that each of the four nations consists of two readers (as before Sweden was split into two subnations for each of which a separate age reading school was expected) gives a total sample size of 272, i.e. a sample size of 68 per nation. The following "nation grouping" (ANOVA, Bonferroni grouping, = 0.05) leads to the conclusion that two significant age reading schools are statistically inherent:

Means with the same letter are not significantly different.

Bon Grouping		Mean	N	NATION
	A	2.54412	68	SLY
	A			
B	A	2.51471	68	D
B	A			
B	A	2.44118	68	SKK
B				
B		2.39706	68	DK

where SLY is Lysekil (Sweden), SKK is Karlskrona (Sweden), D is Rostock (Germany) and DK is Charlottenlund (Denmark). What can be inferred from this is that SLY, D and SKK form one homogenous group on the one hand and on the other hand D, SKK and DK. Only the schools of SLY and DK seem to be statistically different from each other.

In general, in SD 22 the readings of all 8 readers does not deviate very far from true age. But as the curves in Appendix 1 show, most of these are interrupted through discontinuities induced by reader-specific co-variables significantly biasing the age readings. Some of these co-variables are of metric nature, others are dichotomized. The individual calibration models in terms of linear functions are:

Reader 1: read age = -0.12 + 0.82 x true age + 0.38 x rda_mean + 0.01 length
Reader 2: read age = 0.13 + 0.93 x true age
Reader 3: read age = -0.15 + 0.93 x true age + 0.25 x rda
Reader 4: read age = 0.23 + 0.94 x true age
Reader 5: read age = true age
Reader 6: read age = -0.08 + 0.90 x true age + 0.01 x length
Reader 7: read age = 0.36 + 0.89 true age
Reader 8: read age = -0.10 + 0.74 x true age + 0.02 x length

Inverting these, i.e. solving these with respect to "true age" give the individual calibration models by which the individual readings can be standardized (calibrated) and "corrected", respectively. These are:

Reader 1:	true age = (read age - (- 0.12 + 0.38 x rda_mean + 0.01 length)) / 0.82
Reader 2:	true age = (read age - 0.13) / 0.93
Reader 3:	true age = (read age -(-0.15 + 0.25 x rda) / 0.93
Reader 4:	true age = (read age - 0.23) / 0.94
Reader 5:	true age = read age
Reader 6:	true age = (read age -(-0.08 + 0.01 x length)) / 0.90
Reader 7:	true age = (read age - 0.36) /0.89
Reader 8:	true age = (read age -(-0.10 + 0.02 x length))/ 0.74

These equations mean that with exception of reader 5 the remaining 7 readers show a more or less significant bias of their readings. It can be further inferred that the readings of readers 1 and 3 might be additionally influenced by some kind of readability ("rda", "rda_mean") and the readings of readers 1, 6 and 8 by the length of the corresponding fish. Although in some cases (readers 1, 2, 3, 4, 6 and 8) the intercept was not statistically significant (meaning that the readings are not overall vertically shifted/biased) the intercept was left in the model. The reason for doing this is twofold. When left out the statistically insignificant intercept, empirical predictions resulted in much worse outcomes than without calibration (correction). The statistical reason behind this might be that the used significance tests only control the Type I error (i.e., the significance level) but not the Type II error. Consequently, the non-rejection of the null hypothesis does not necessarily mean that the null hypothesis is true meaning that by some probability the intercept may indicate vertical bias. However, when including the statistically insignificant intercept the results were at least the same or better than in the uncorrected case.

For SD 22 only in case of reader 1 the correction of the readings led to an obvious improvement.

SD 24

Also in SD 24, 8 readers were involved in the readings of the 49 otoliths in total. From their readings CVs, modal age, median age and rounded mean age were calculated for each otolith. Also here modal age was chosen as definition and approximation, respectively, of the corresponding true age. Compared with SD 22 the smaller number of only 7 CVs with a value of 0% indicate a much higher disagreement between readers than in SD 22 (disagreement in 84% of the cases). This observation is confirmed by the fact that the remaining CVs vary between 9% and 283%. The fact that mode, median and rounded mean only differ in three cases also here marks a relatively high stability of these 3 true age indices. It confirms the observation of SD 22 that the age readings seem to be normal over the 8 readers.

Among the 6 participating readers of otoliths from SD 24 total agreement was found in only 10 of the 49 otoliths.

These 10 otoliths were supplied with 7 further otoliths upon which the four participating readers reached agreement. One exception is the otolith of fish no. 9 from the circulated sample. Although we had different interpretations this otolith was chosen to be included into the reference sample because we agreed that it is a typical one for this area.

The final reference collection contains cod of sizes from 9 to 80 cm, and ages from 0 to 5 years. Only the quarters 1, 3 and 4 are represented, due to disagreement on the interpretation on otoliths from April and May. 12 specimen are represented with more than one otolith.

Taking into account the 49 individual readings of each of the 8 readers and that each of the four nations consists of two readers (as before Sweden was split into two subnations for each of which a separate age reading school was expected) gives a total sample size of 392, i.e. a sample size of 98 per nation. The following "nation/subnation grouping" (ANOVA, Bonferroni grouping, = 0.05) leads to the conclusion that three significant age reading schools are statistically inherent:

Means with the same letter are not significantly different.

Bon Grouping		Mean	N	NATION
	A	2.68367	98	D
	A			
B	A	2.51020	98	SLY
B				
B	C	2.44898	98	SKK
C				
C		2.28571	98	DK

where D is Rostock (Germany), SLY is Lysekil (Sweden), SKK is Karlskrona (Sweden) and DK is Charlottenlund (Denmark). What can be inferred from this is that D and SLY, SLY and SKK, SKK and DK each form one homogenous group. Only the schools of D and DK seem to be statistically different from each other.

In general, in SD 24 the readings of all 8 readers deviate much farther from true age than in SD 22. As the curves in the Numerical Output Section (7.) show, most of these are interrupted through discontinuities induced by reader-specific co-variables significantly biasing the age readings. The curves are more complicated than in SD 22 and are not simple lines or step functions. As in SD 22 some of these co-variables are of metric nature, others are binary. The individual calibration models in terms of linear functions are (the parameter values are rounded to the second position behind the decimal point):

Reader 1: read age = 1.06 x true age + 0.98 rda + 0.44 rda_good - 0.00026 rectangl
Reader 2: read age = 0.35 + 0.75 x true age
Reader 3: read age = 0.18 + 0.94 x true age
Reader 4: read age = -0.26 + 0.97 x true age + 0.62 rda
Reader 5: read age = 0.98 x true age
Reader 6: read age = 0.90 x true age - 0.11 rda_good + 0.0094 length
Reader 7: read age = 1.03 + 1.01 x true age - 0.27 quarter
Reader 8: read age = 0.95 x true age

Converting these linear equations to calibration models give:

Reader 1: true age = (read age - (0.98 rda + 0.44 rda_good - 0.00026 rectangl)) / 1.06
Reader 2: true age = (read age - 80.35) / 0.75
Reader 3: true age = (read age - 0.18) / 0.94
Reader 4: true age = (read age -(-0.26 + 0.62 rda)) / 0.97
Reader 5: true age = read age / 0.98
Reader 6: true age = (read age - (- 0.11 rda_good + 0.0094 length)) / 0.90
Reader 7: true age = (read age -(1.03 - 0.27 quarter)) / 1.01
Reader 8: true age = read age / 0.95

These equations mean that all readers show a more or less significant bias of their readings, i.e. significant deviations from the calibration standard. It can be further inferred that the readings of readers 1 and 4 might be additionally influenced by some kind of readability ("rda", "rda_good"), the readings of reader 6 by a size component ("length") of the corresponding fish, reader 1 by some local component ("rectangl"), reader 7 by some time component (quarter).

In case of readers 1, 6 and 8 associated significance tests indicate that intercepts play no role, i.e. that intercepts are statistically insignificant. Furthermore, in these three cases inverse age predictions of "intercept-free models" were much better than in case of models with intercept. Therefore, in these three cases calibration models were created without estimating intercepts.

Although in case of readers 3 and 4 the intercepts were also statistically insignificant these models were estimated with intercept since the prediction power of the "intercept models" was much higher than of the "intercept-free models". The statistical reasoning for doing so in the current work is the following. The formulation of statistical tests usually does not control the type II error. I.e., the non-rejection of the null hypothesis does not necessarily mean that the null hypothesis is actually true. It can be but it must not. Therefore,

in case of the non-rejection of the null hypothesis it is at least very helpful (if not necessary) to have a further criterion which is able to indicate whether the decision of leaving out the intercept is a plausible one or not. In the current work this criterion was given by checking the inverse age prediction power.

Another statistical artifact is that of multicollinearity. Although external intercorrelation is usually unwanted it can improve the forecasting or prediction properties of regression models in some cases (for more details on this phenomenon see Hansen 1989, Neter *et al.* 1985). In case of reader 1 the overlapping information between "rda" and "rda_good" obviously functioned as an amplification. It improved the true age predictions of reader 1 drastically where "rda" is formulated as an ordinarily scaled variable and "rda_good" as a dichotomous one with value 1 if the readability was estimated as good and with value 0 otherwise.

For SD 24 the correction of the age readings led to an obvious improvement in case of readers 1, 2 and 7.

SD 21

Readings and marking out structures on paper copies have been performed by the Swedish and the Danish institutes. The data are presently being collected and quantitative analysis of readers interpretations of structures will be performed at the Danish Institute.

SD 25

The exchange programme is still in action, but eventually the data will be collected and processed by the Danish institute.

SD 23 + 27 + 29 + 30 + 32

The exhange program is in progress in Sub-divisions 23, 27 and 29–32, and until now no results have been obtained.

SD 26

In SD 26 three readers were involved in the readings of the 38 otoliths in total. From their readings CVs, modal age, median age and rounded mean age were calculated for each of the otoliths. In contrast to Sub-divisions 22 and 24 the median was chosen as definition and approximation, respectively, for the corresponding true age and not the modal age. The reason is: when having only a small group of readers (as in the current case) for the modal age the probability of a non-unique solution is relatively high due to total disagreement. In such a situation the advantage of the median is its similarly good approximation properties (see Gröger 1996b) together with the fact that it is unique in any case. The large number of 18 CVs with a value of 0% indicates a generally high agreement between the 3 readers (disagreement in only 53% of the cases). This is confirmed by the fact that the remaining 20 CVs moderately range between 5% and 33% and that mode, median and rounded mean only differ in three cases which marks a relatively high stability of these three indices. The latter also underlines the assumption that the observations are normal over the readers. One cause may be that SD 26 is a relatively homogenous area.

The following significant schools could be identified statistically (ANOVA, Bonferroni grouping, = 0.05):

Means with the same letter are not significantly different.

Bon Grouping	Mean	N	NATION
A	4.5000	38	LV
A			
A	4.3947	38	POL
B	3.8684	38	SW

where LV is Latvia, POL is Poland and SW is Sweden. What can be inferred from this is that LV and POL on the one hand and SW on the other hand form homogenous groups and that both schools are statistically different from each other.

In general, in SD 26 the readings of all 3 readers do not deviate very far from true age. But as the curves in Appendix 1 show, most of these are interrupted through discontinuities induced by reader-specific co-variables significantly biasing the age readings. Some of these co-variables are of metric nature, others are dichotomized. The individual calibration models in terms of linear functions are:

Reader 1:	read age = 0.967 x true age + 0.450 x size
Reader 2:	read age = 1.024 x true age
Reader 3:	read age = 0.879 x true age

These linear equations mean that all readers show a more or less significant bias of their readings. It can be further inferred that the readings of reader 1 might be additionally influenced by some kind of size where size = (length > 38) is a dichotomous variable taking the value 1 when larger than 38 and 0 otherwise. The limit 38 was empirically found by iterating the value when looking for a structural break (discontinuation).

In all cases the intercept was not significant and non-estimation of the intercept did not deteriorate the forecasting quality.

For SD 26 the correction of the age readings led to an obvious improvement in case of reader 1.

SD 28

In SD 28 the same 3 readers as in SD 26 were involved in the readings of the 42 otoliths in total. From their readings CVs, modal age, median age and rounded mean age were calculated for each otolith. As outlined under SD 26 also here the median was chosen as an approximation for true age. Compared with SD 26 the smaller number of 13 CVs with a value of 0% indicate a slightly higher disagreement between the 3 readers than in SD 26 (disagreement in 69% of the cases). This observation is confirmed by the fact that the remaining 29 CVs vary between 6% and 43%. I.e. also here the maximum value is generally small but by 10% percent points higher than in SD 26. The fact that mode, median and rounded mean only differ in 4 cases marks a relatively high stability of these three indices. It confirms the observation of SD 26 that the age readings seem to be normal over the 3 readers.

The following significant schools could be statistically identified (ANOVA, Bonferroni grouping, = 0.05):

Means with the same letter are not significantly different.

Bon Grouping	Mean	N	NATION
A	4.0952	42	POL
A			
A	3.9286	42	LV
B	3.4286	42	SW

where POL is Poland, LV is Latvia and SW is Sweden. Obviously the same picture is drawn as in SD 26: POL and LV form one homogenous group on the one hand and SW on the other hand. Both schools are statistically different from each other.

In general, in SD 28 the readings of all 3 readers deviate farther from true age than in SD 26. As the curves in the Numerical Output Section (item 7.) show, all of these are interrupted through discontinuities induced by reader-specific co-variables significantly biasing the age readings. The curves are slightly more complicated than in SD 26. As in SD 26 some of these co-variables are of metric nature, others are dichotomous. The individual calibration models in terms of linear functions are:

Reader 1:	read age = 0.992 x true age - 0.313 x month + 0.944 x quarter
Reader 2:	read age = 0.991 x true age - 0.452 x rda_good + 0.000143 x rectangl
Reader 3:	read age = 0.874 x true age

These linear equations mean that all readers show a more or less significant bias of their readings. It can be further inferred that the readings of reader 1 might be additionally influenced by some kind of time component

("month", "quarter") and reader 2 by some kind of readability ("rda_good") as well as by a local component ("rectangl"). In all cases the intercept was not significant. Leaving out the intercept did not deteriorate the forecasting quality. As in SD 24 multicollinearity improved the forecasting or prediction property of the regression model in case of reader 1 obviously: the overlapping information between "month" and "quarter" may have functioned as an amplifier. It improved the inverse prediction of true age drastically.

For SD 28 the true age prediction (correction of the age readings) led to an improvement in all three cases.

3.4 Digitized Video Images of Otoliths

It is the aim to produce a data base of digitized images of all otoliths in the Baltic cod otolith reference collections.

Access to digitized image analysis provide a number of additional advantages for maintenance and analysis of a reference otolith collection. However, it should only be regarded as a complement to the physical collection itself.

The frame grabbing facilities at the Danish institute were employed to produce digitized images of otolith parts and close ups on transections (see Figures 1a and 1b). The work was initiated for the collections from SD 21, 24 and 25 during 1996.

Two types of digitized video images are being produced, 1) all existing otolith parts from each individual, and 2) the magnified otolith transection surface used for ageing (otoliths were covered by water and for fish more than one year old they also had been polished). Each image was provided with an identifying string of text including: Fish population, Sub-division, year, month, an individual identifier (sub-collection and no.), and magnification or a scale directly on the image. In type 1) images the otolith part containing the transection was marked out with an arrow. When type 2) images did not reproduce optimally, arrows and explaining text were put in to help interpretation.

The present collection of images is continuously being stored on computer hard discs (HD). When the reference collections are complete the entire image data base will be copied to CD-ROM and made available to the participating institutes.

In connection with the circulation of otoliths from SD 21 and 25, paper prints from the data base of 1) otolith parts were produced for identification purposes and microscope images of 2) transections were supplied for marking out identified structures.

Two sets of prints were supplied directly to each institute. A printed procedure was enclosed as a guide for using image prints in age reading and handling of the otolith collections (see appendix 3B).

The otolith collections were circulated among the institutes involved in age readings of cod from the respective Baltic Sub-divisions.

The instructions were that readers should return (to the Danish Institute) their otolith prints with marks for each structure. The position of the marks would then be measured and the results analysed to compare readings in a quantitative way.

No complete quantitative analysis of readers interpretations is available as yet, but the technique of digitized image aid in age reading was presented and discussed at the meeting. There was a general consensus that the technique should be further employed and evaluated.

3.5 Information Concerning the Finally Selected Reference Collection

The experts at ageing of otoliths from SD 22+24 went through the material from these Sub-divisions and from that they selected the reference samples as described for each Sub-division.

The reference otolith samples will now be taken to the Danish Institute for Fisheries Research, the Department for Marine Fisheries, in Charlottenlund.

Here two digitized images will be produced of the pieces of otoliths as found in the envelopes and the broken/polished surface that is chosen for reading.

The digitized pictures stored on CD-Rom will create the foundation for later discussions. This will make it possible for future readers to point out the different growth zones and their interpretation of the otolith. This will make it possible to do some measurements on the material as suggested by the area coordinator during the circulation of the Sub-division 25 otoliths. To make sure that the material will be comparable among different readers to standardize the marking out of growth zones along a common growth axis. It has to be investigated what axis gives the most reproducible results.

SD 26 + 28

The reference collections present mainly otoliths that are typical (by their structure and width of otolith zones) for each Sub-division. Otoliths were taken from fishes with medium growth rate, as well as from slowly and rapidly growing fishes. Along with otoliths that are typical for each Sub-division the collections include both nontypical otoliths as well as ones that are more characteristic for cod from Western Baltic by the width of the zones.

Collection of cod otoliths for SD 26

The final collection contains 38 otoliths from which 10 are from Latvia, 14 are from Poland, and 14 are from Sweden.

For quarter I: 11 otoliths were chosen representing age groups 1–10. Otoliths with an opaque zone on the otolith edge prevailed.

For quarter II: 6 otoliths of age groups 2–7 were chosen. A zone on the otolith edge varies strongly from "small hyaline zone" to "wide opaque zone".

For quarter III: 11 otoliths of age groups 2–11 were taken. In about 50% of the cases a narrow opaque zone could be seen on the otolith edge, but in the rest a narrow or wide hyaline zone could be observed.

For quarter IV: 10 otoliths of age groups 1–9 are presented. The zone on the otolith edge strongly varies. It should be noted that this part of the collection includes the otoliths of cod with maturity stages seven and eight (spawning and post-spawning cod). Late spawning of cod in recent years has been common. Therefore, otoliths representing these individuals are found in the collection.

Collection of cod otoliths for SD 28

The reference collection of cod otoliths for SD 28 includes 42 specimens out of which 20 are from Sweden and 22 are from Latvian samples. The collection contains the otoliths collected in quarters I, III and IV of 1995.

For quarter I: 17 otoliths were chosen (8 of them were from Sweden and 9 were from Latvia). These otoliths belong to age groups 1–9. Most of them exhibit a narrow or wide opaque zone on the edge.

For quarter III: 12 otoliths represent age groups 1–10. About half of them have a hyaline zone (narrow or wide) on the edge and the other half have a narrow opaque zone on the edge.

For quarter IV: 13 otoliths represent age groups 1–7. A narrow opaque zone dominates on the otolith edge in this period. several otoliths of fishes with maturity stages seven and eight (having recently spawned) are presented here, for the same reason as for the SD 26 collection.

SD 23, 27, 29–32

The reference collection in Sub-divisions 23, 27 and 29–32 are in progress and will be available after completion of the exchange programs.

4 CONCLUSIONS

1. It was possible to establish reference collections for cod otoliths from SD 22+24 and SD 26+28. The exchange program of SD 21+25 is still in progress. The Group decided to do this by correspondence.

2. The applied multiple linear regression approach together with the "true age" concept could detect the influence of (direct or latent) external factors influencing the readings of the individual readers. Following the theory of the calibration technique and the basics of the expectation theory a significant influence (of one or more factors) is nothing else than a personal empirical bias since it is measured as distance between the observed regression line (which is similar to an estimated mean or trend) and the calibration standard (which is similar to the expected mean or regression line). Tests on the significance of the associated regression parameters including the intercept can indicate whether the readings are biased or not. Contrasting the resulting values of the estimated regression parameters to the expected ones (which are 0 or 1; see Gröger 1996a, b, c) can quantify the size of the bias. The calibration standard was defined here as "true age" and was approximated by some statistical measure as the interpersonal mode or median. Since the corresponding exact age was not known the exact bias is also unknown. Therefore, the empirically found bias is an approximation of the exact one and can be taken as long valid until better or perfect information will be available. In contrast to the (systematic) bias the personal precision measures that dispersion which surrounds the observed regression line (randomly). Carrying out a decomposition of the variance structure gives more detailed information about the size of the different variance components, especially about the size of the unexplained dispersion. The latter is important for a detailed analysis of the residuals.

   Furthermore, it was not only an elegant way to compare the readings of different readers but also an appropriate tool of age reading calibration. Through inverse prediction read age could be statistically corrected towards true age. I.e., the calibration led to a harmonization of the individual age readings between readers and therefore to a homogenization of the age reading results. From that point of view the application of such models can be considered as a big step towards improvement.

3. The Group found it useful to mark out the position of different otolith structures (i.e.: metarmophosis ring, juvenile rings, annual hyaline zones).

4. Various environmental conditions may influence the formation of hyaline zones, therefore, the interpretation of them as annual markers should be cautious.

5. It was generally agreed that the expressions "summer and winter ring" may be misleading. The Group found that for practical use it is better to use the expressions opaque and hyaline zone.

6. The daily increments may be used in order to obtain information about the calendar date of hyaline zones (so called winter rings) formation, occurrence of a "metamorphosis ring" and of "juvenile ring/s" may by analyzed as well.

7. The Group found it necessary to validate the geographically specific time of the hyaline zone formation.

8. The samples of otoliths collected according to the agreed areas should also be read by the specialists working on otoliths from the adjacent areas. Practically this means all specialists from Eastern Baltic.

5 RECOMMENDATIONS

Based on the problems identified at this workshop it is recommended that:

1. The selection of reference collections of otoliths by sub-areas should continue under the leadership of the area-coordinators. The selection of reference collections should be based on the statistical analysis presented at this meeting.

2. A workshop should be held within two years in order

   - to present a reference collection by seasons and areas in accordance with the item 3 of this report
   - to prepare a manual based on the reference collection which provides guidelines for age reading procedures and interpretation of otoliths

3. During the period between the two workshops (1996 and 1998) the "Study Group on Cod Age-Reading" should work by correspondence under the leadership of the two Co-Chairmen.

6 REFERENCES

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7 NUMERICAL OUTPUT

. SD 22

A G E R E A D I N G

Date - Time : 08OCT96 - 16:44:28
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD22.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\STAT22_1.OUT

Number data records : 272
Approx. of True Age : Mode
Width of CV category: 10

CVGROUP=1

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
1	10	1	1	1	1.000	1	0.00000
2	10	5	2	2	2.000	2	0.00000
3	10	7	2	2	2.000	2	0.00000
4	10	8	3	3	3.000	3	0.00000
5	10	9	3	3	3.000	3	0.00000
6	10	10	4	4	4.000	4	0.00000
7	10	11	4	4	4.000	4	0.00000
8	10	14	1	1	1.000	1	0.00000
9	10	15	1	1	1.000	1	0.00000
10	10	16	2	2	2.000	2	0.00000
11	10	20	2	2	2.000	2	0.00000
12	10	21	2	2	2.000	2	0.00000
13	10	22	2	2	2.000	2	0.00000
14	10	23	3	3	3.000	3	0.00000
15	10	24	3	3	3.000	3	0.00000
16	10	25	3	3	3.000	3	0.00000
17	10	26	4	4	4.000	4	0.00000
18	10	29	1	1	1.000	1	0.00000
19	10	30	2	2	2.000	2	0.00000
20	10	31	2	2	2.000	2	0.00000
21	10	34	3	3	3.000	3	0.00000
22	10	12	5	5	4.875	5	7.25238
23	10	28	4	4	4.125	4	8.57099
24	10	18	4	4	3.875	4	9.12396

CVGROUP=2

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
25	20	27	3	3.5	3.500	4	15.2721

26	20	6	2	2.0	2.125	2	16.6378
27	20	17	2	2.0	2.125	2	16.6378
28	20	33	2	2.0	2.125	2	16.6378
29	20	4	3	3.0	2.750	3	16.8331

---------- CVGROUP=3 ----------

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
30	30	19	2	2	2.25	2	20.5738
31	30	32	2	2	2.25	2	20.5738

---------- CVGROUP=4 ----------

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
32	40	13	1	1.0	1.125	1	31.4270
33	40	2	1	1.5	1.500	2	35.6348
34	40	3	1	1.5	1.500	2	35.6348

3

General Linear Models Procedure
Class Level Information

Class	Levels	Values
NATION	4	D DK SKK SLY
TRUE	5	1 2 3 4 5

Number of observations in data set = 272

4

General Linear Models Procedure

Dependent Variable: AGE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	273.84772948	39.12110421	470.05	0.0001
Error	264	21.97212346	0.08322774		
Corrected Total	271	295.81985294			

R-Square	C.V.	Root MSE	AGE Mean
0.925725	11.65971	0.2884922	2.4742647

Source	DF	Type I SS	Mean Square	F Value	Pr > F

NATION	3	0.92279412	0.30759804	3.70	0.0124
TRUE	4	272.92493536	68.23123384	819.81	0.0001
Source	DF	Type III SS	Mean Square	F Value	Pr > F
NATION	3	0.92279412	0.30759804	3.70	0.0124
TRUE	4	272.92493536	68.23123384	819.81	0.0001

5

General Linear Models Procedure

Bonferroni (Dunn) T tests for variable: AGE

NOTE: This test controls the type I experimentwise error rate, but generally has a higher type II error rate than REGWQ.

Alpha= 0.05 df= 264 MSE= 0.083228
Critical Value of T= 2.66
Minimum Significant Difference= 0.1315

Means with the same letter are not significantly different.

Bon Grouping		Mean	N	NATION
	A	2.54412	68	SLY
	A			
B	A	2.51471	68	D
B	A			
B	A	2.44118	68	SKK
B				
B		2.39706	68	DK

A G E R E A D I N G

Date - Time : 27SEP96 - 16:19:18
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD22.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD22BRA.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD22BRA.DP

Reader : 'READER 1 '
Number data records : 34

Dependent Variable : read
Independ. Variable/s: true rda_mean length (3)
Options (PROC REG) :
Size Def. : length > 38

Regression and Tests

2

Model: M1
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	3	36.24430	12.08143	95.755	0.0001
Error	30	3.78511	0.12617		
C Total	33	40.02941			

Root MSE	0.35520	R-square	0.9054
Dep Mean	2.61765	Adj R-sq	0.8960
C.V.	13.56961		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.116349	0.19390295	-0.600	0.5530
TRUE	1	0.817604	0.09310132	8.782	0.0001
RDA_MEAN	1	0.373101	0.13523083	2.759	0.0098
LENGTH	1	0.014161	0.00574384	2.465	0.0196

Regression and Tests 3

Dependent Variable: READ
Test: T_TRUE Numerator: 0.4843 DF: 1 F value: 3.8381
Denominator: 0.12617 DF: 30 Prob>F: 0.0595

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1.28571	0.85714	22.2857	37.9517	7
2	2.23077	0.65385	43.3846	19.6582	13
3	3.12500	0.50000	54.7500	11.3137	8
4	4.20000	0.60000	63.0000	10.6479	5
5	5.00000	1.00000	67.0000	.	1

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.0000	1	0.5	0.85714	1	0	12	22.2857	1

2	35.6348	2	1.0	0.85714	0	1	18	22.2857	1
3	35.6348	2	1.0	0.85714	0	1	23	22.2857	1
4	16.8331	1	0.5	0.50000	1	0	26	54.7500	3
5	0.0000	1	0.5	0.65385	1	0	33	43.3846	2
6	16.6378	1	0.5	0.65385	1	0	36	43.3846	2
7	0.0000	1	0.5	0.65385	1	0	43	43.3846	2
8	0.0000	1	0.5	0.50000	1	0	47	54.7500	3
9	0.0000	1	0.5	0.50000	1	0	54	54.7500	3
10	0.0000	1	0.5	0.60000	1	0	56	63.0000	4
11	0.0000	1	0.5	0.60000	1	0	63	63.0000	4
12	7.2524	2	1.0	1.00000	0	1	67	67.0000	5
13	31.4270	2	1.0	0.85714	0	1	19	22.2857	1
14	0.0000	2	1.0	0.85714	0	1	23	22.2857	1
15	0.0000	2	1.0	0.85714	0	1	27	22.2857	1

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.28571	0.87119	-0.12881	0.41452	0.12881	0	0
2	2	1.28571	1.32926	0.32926	-0.04354	0.67074	1	1
3	2	1.28571	1.40006	0.40006	-0.11435	0.59994	1	1
4	3	3.12500	2.70465	-0.29535	0.42035	0.29535	0	0
5	2	2.23077	1.98618	-0.01382	0.24459	0.01382	0	0
6	2	2.23077	2.02866	0.02866	0.20211	-0.02866	0	0
7	2	2.23077	2.12779	0.12779	0.10298	-0.12779	0	0
8	3	3.12500	3.00204	0.00204	0.12296	-0.00204	0	0
9	3	3.12500	3.10117	0.10117	0.02383	-0.10117	0	0
10	4	4.20000	3.94709	-0.05291	0.25291	0.05291	0	0
11	4	4.20000	4.04622	0.04622	0.15378	-0.04622	0	0
12	5	5.00000	5.29357	0.29357	-0.29357	-0.29357	0	0
13	1	1.28571	1.34342	0.34342	-0.05770	-0.34342	0	0
14	1	1.28571	1.40006	0.40006	-0.11435	-0.40006	0	0
15	1	1.28571	1.45671	0.45671	-0.17099	-0.45671	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	1.15755	0.15755	0.1575	1	0	0
2	1.82038	0.82038	0.8204	2	1	1
3	1.73377	0.73377	0.7338	2	1	1
4	3.36123	0.36123	0.3612	3	0	0
5	2.01691	0.01691	0.0169	2	0	0
6	1.96494	-0.03506	0.0351	2	0	0
7	1.84370	-0.15630	0.1563	2	0	0
8	2.99751	-0.00249	0.0025	3	0	0
9	2.87626	-0.12374	0.1237	3	0	0
10	4.06471	0.06471	0.0647	4	0	0
11	3.94347	-0.05653	0.0565	4	0	0
12	4.64094	-0.35906	0.3591	5	0	0
13	0.57997	-0.42003	0.4200	1	0	0
14	0.51069	-0.48931	0.4893	1	0	0
15	0.44141	-0.55859	0.5586	0	-1	1

Estim. of means, biases and dispersion 6

Readability	Inverted Readab.	Average Readab.	Average	True

Otol. No.	Otol. Uncert.	of Otol.	of Otol.	of Otol.	Good Readab.	Worse Readab.	Fish Length	Fish Length	Age Class
16	0.0000	2	1.0	0.65385	0	1	32	43.3846	2
17	16.6378	2	1.0	0.65385	0	1	38	43.3846	2
18	9.1240	1	0.5	0.60000	1	0	44	63.0000	4
19	20.5738	1	0.5	0.65385	1	0	51	43.3846	2
20	0.0000	1	0.5	0.65385	1	0	38	43.3846	2
21	0.0000	1	0.5	0.65385	1	0	43	43.3846	2
22	0.0000	1	0.5	0.65385	1	0	48	43.3846	2
23	0.0000	1	0.5	0.50000	1	0	52	54.7500	3
24	0.0000	1	0.5	0.50000	1	0	60	54.7500	3
25	0.0000	1	0.5	0.50000	1	0	63	54.7500	3
26	0.0000	1	0.5	0.60000	1	0	68	63.0000	4
27	15.2721	1	0.5	0.50000	1	0	75	54.7500	3
28	8.5710	2	1.0	0.60000	0	1	84	63.0000	4
29	0.0000	1	0.5	0.85714	1	0	34	22.2857	1
30	0.0000	1	0.5	0.65385	1	0	45	43.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	2	2.23077	2.34512	0.34512	-0.11435	-0.34512	0	0
17	3	2.23077	2.43009	0.43009	-0.19932	0.56991	1	1
18	4	4.20000	3.77716	-0.22284	0.42284	0.22284	0	0
19	2	2.23077	2.24108	0.24108	-0.01031	-0.24108	0	0
20	2	2.23077	2.05698	0.05698	0.17379	-0.05698	0	0
21	2	2.23077	2.12779	0.12779	0.10298	-0.12779	0	0
22	2	2.23077	2.19860	0.19860	0.03217	-0.19860	0	0
23	3	3.12500	3.07284	0.07284	0.05216	-0.07284	0	0
24	3	3.12500	3.18613	0.18613	-0.06113	-0.18613	0	0
25	3	3.12500	3.22862	0.22862	-0.10362	-0.22862	0	0
26	4	4.20000	4.11703	0.11703	0.08297	-0.11703	0	0
27	4	3.12500	3.39855	0.39855	-0.27355	0.60145	1	1
28	5	4.20000	4.71671	0.71671	-0.51671	0.28329	1	1
29	1	1.28571	1.18274	0.18274	0.10298	-0.18274	0	0
30	2	2.23077	2.15611	0.15611	0.07466	-0.15611	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	1.57789	-0.42211	0.4221	2	0	0
17	2.69705	0.69705	0.6971	3	1	1
18	4.27255	0.27255	0.2726	4	0	0
19	1.70514	-0.29486	0.2949	2	0	0
20	1.93030	-0.06970	0.0697	2	0	0
21	1.84370	-0.15630	0.1563	2	0	0
22	1.75710	-0.24290	0.2429	2	0	0
23	2.91090	-0.08910	0.0891	3	0	0
24	2.77234	-0.22766	0.2277	3	0	0
25	2.72038	-0.27962	0.2796	3	0	0
26	3.85687	-0.14313	0.1431	4	0	0
27	3.73562	0.73562	0.7356	4	1	1
28	4.34649	0.34649	0.3465	4	0	0
29	0.77650	-0.22350	0.2235	1	0	0
30	1.80906	-0.19094	0.1909	2	0	0

Estim. of means, biases and dispersion 7

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Average Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	0.0000	2	1.0	0.65385	0	1	49	43.3846	2
32	20.5738	1	0.5	0.65385	1	0	51	43.3846	2
33	16.6378	2	1.0	0.65385	0	1	57	43.3846	2
34	0.0000	1	0.5	0.50000	1	0	61	54.7500	3

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.23077	2.58586	0.58586	-0.35509	-0.58586	0	0
32	3	2.23077	2.24108	0.24108	-0.01031	0.75892	1	1
33	3	2.23077	2.69915	0.69915	-0.46838	0.30085	1	1
34	3	3.12500	3.20030	0.20030	-0.07530	-0.20030	0	0
				7.00000	-0.00000	-0.00000	7	7

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	1.28345	-0.71655	0.7166	1	-1	1
32	2.92823	0.92823	0.9282	3	1	1
33	2.36797	0.36797	0.3680	2	0	0
34	2.75502	-0.24498	0.2450	3	0	0
		-0.00000	11.0049		3	7

A G E R E A D I N G

Date - Time : 27SEP96 - 16:19:34
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD22.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD22BRO.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD22BRO.DP

Reader : 'READER 2 '
Number data records : 34

Dependent Variable : read
Independ. Variable/s: true (1)
Options (PROC REG) :
Size Def. : length > 38

Model: M1
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	33.23403	33.23403	1337.075	0.0001
Error	32	0.79538	0.02486		
C Total	33	34.02941			

Root MSE	0.15766	R-square	0.9766
Dep Mean	2.38235	Adj R-sq	0.9759
C.V.	6.61771		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.133846	0.06717349	1.993	0.0549
TRUE	1	0.932308	0.02549655	36.566	0.0001

Regression and Tests 3

Dependent Variable: READ
Test: T_TRUE Numerator: 0.1752 DF: 1 F value: 7.0488
Denominator: 0.024856 DF: 32 Prob>F: 0.0123

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1	0	22.2857	0	7
2	2	0	43.3846	0	13
3	3	0	54.7500	0	8
4	4	0	63.0000	0	5
5	4	0	67.0000	.	1

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length
1	0.0000	.	0	0	0	0	12	22.2857
2	35.6348	.	0	0	0	0	18	22.2857
3	35.6348	.	0	0	0	0	23	22.2857

4	16.8331	.	0	0	0	0	26	54.7500
5	0.0000	.	0	0	0	0	33	43.3846
6	16.6378	.	0	0	0	0	36	43.3846
7	0.0000	.	0	0	0	0	43	43.3846
8	0.0000	.	0	0	0	0	47	54.7500
9	0.0000	.	0	0	0	0	54	54.7500
10	0.0000	.	0	0	0	0	56	63.0000
11	0.0000	.	0	0	0	0	63	63.0000
12	7.2524	.	0	0	0	0	67	67.0000
13	31.4270	.	0	0	0	0	19	22.2857
14	0.0000	.	0	0	0	0	23	22.2857
15	0.0000	.	0	0	0	0	27	22.2857

Otol. No.	True Age Class	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1	1	1.06615	0.06615	-0.06615	-0.06615	0	0
2	1	1	1	1.06615	0.06615	-0.06615	-0.06615	0	0
3	1	1	1	1.06615	0.06615	-0.06615	-0.06615	0	0
4	3	3	3	2.93077	-0.06923	0.06923	0.06923	0	0
5	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0
6	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0
7	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0
8	3	3	3	2.93077	-0.06923	0.06923	0.06923	0	0
9	3	3	3	2.93077	-0.06923	0.06923	0.06923	0	0
10	4	4	4	3.86308	-0.13692	0.13692	0.13692	0	0
11	4	4	4	3.86308	-0.13692	0.13692	0.13692	0	0
12	5	4	4	4.79538	-0.20462	-0.79538	-0.79538	-1	1
13	1	1	1	1.06615	0.06615	-0.06615	-0.06615	0	0
14	1	1	1	1.06615	0.06615	-0.06615	-0.06615	0	0
15	1	1	1	1.06615	0.06615	-0.06615	-0.06615	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	0.92904	-0.07096	0.07096	1	0	0
2	0.92904	-0.07096	0.07096	1	0	0
3	0.92904	-0.07096	0.07096	1	0	0
4	3.07426	0.07426	0.07426	3	0	0
5	2.00165	0.00165	0.00165	2	0	0
6	2.00165	0.00165	0.00165	2	0	0
7	2.00165	0.00165	0.00165	2	0	0
8	3.07426	0.07426	0.07426	3	0	0
9	3.07426	0.07426	0.07426	3	0	0
10	4.14686	0.14686	0.14686	4	0	0
11	4.14686	0.14686	0.14686	4	0	0
12	4.14686	-0.85314	0.85314	4	-1	1
13	0.92904	-0.07096	0.07096	1	0	0
14	0.92904	-0.07096	0.07096	1	0	0
15	0.92904	-0.07096	0.07096	1	0	0

Estim. of means, biases and dispersion 6

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Average Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length

16	0.0000	.	0	0	0	0	32	43.3846
17	16.6378	.	0	0	0	0	38	43.3846
18	9.1240	.	0	0	0	0	44	63.0000
19	20.5738	.	0	0	0	0	51	43.3846
20	0.0000	.	0	0	0	0	38	43.3846
21	0.0000	.	0	0	0	0	43	43.3846
22	0.0000	.	0	0	0	0	48	43.3846
23	0.0000	.	0	0	0	0	52	54.7500
24	0.0000	.	0	0	0	0	60	54.7500
25	0.0000	.	0	0	0	0	63	54.7500
26	0.0000	.	0	0	0	0	68	63.0000
27	15.2721	.	0	0	0	0	75	54.7500
28	8.5710	.	0	0	0	0	84	63.0000
29	0.0000	.	0	0	0	0	34	22.2857
30	0.0000	.	0	0	0	0	45	43.3846

Otol. No.	True Age Class	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0
17	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0
18	4	4	4	3.86308	-0.13692	0.13692	0.13692	0	0
19	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0
20	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0
21	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0
22	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0
23	3	3	3	2.93077	-0.06923	0.06923	0.06923	0	0
24	3	3	3	2.93077	-0.06923	0.06923	0.06923	0	0
25	3	3	3	2.93077	-0.06923	0.06923	0.06923	0	0
26	4	4	4	3.86308	-0.13692	0.13692	0.13692	0	0
27	3	3	3	2.93077	-0.06923	0.06923	0.06923	0	0
28	4	4	4	3.86308	-0.13692	0.13692	0.13692	0	0
29	1	1	1	1.06615	0.06615	-0.06615	-0.06615	0	0
30	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	2.00165	0.00165	0.00165	2	0	0
17	2.00165	0.00165	0.00165	2	0	0
18	4.14686	0.14686	0.14686	4	0	0
19	2.00165	0.00165	0.00165	2	0	0
20	2.00165	0.00165	0.00165	2	0	0
21	2.00165	0.00165	0.00165	2	0	0
22	2.00165	0.00165	0.00165	2	0	0
23	3.07426	0.07426	0.07426	3	0	0
24	3.07426	0.07426	0.07426	3	0	0
25	3.07426	0.07426	0.07426	3	0	0
26	4.14686	0.14686	0.14686	4	0	0
27	3.07426	0.07426	0.07426	3	0	0
28	4.14686	0.14686	0.14686	4	0	0
29	0.92904	-0.07096	0.07096	1	0	0
30	2.00165	0.00165	0.00165	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length
31	0.0000	.	0	0	0	0	49	43.3846
32	20.5738	.	0	0	0	0	51	43.3846
33	16.6378	.	0	0	0	0	57	43.3846
34	0.0000	.	0	0	0	0	61	54.7500

Otol. No.	True Age Class	Mean Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0
32	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0
33	2	2	2	1.99846	-0.00154	0.00154	0.00154	0	0
34	3	3	3	2.93077	-0.06923	0.06923	0.06923	0	0
					-1.00000	-0.00000	-0.00000	-1	1

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	2.00165	0.00165	0.00165	2	0	0
32	2.00165	0.00165	0.00165	2	0	0
33	2.00165	0.00165	0.00165	2	0	0
34	3.07426	0.07426	0.07426	3	0	0
		-0.00000	2.69967		-1	1

A G E R E A D I N G

Date - Time : 27SEP96 - 16:19:48
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD22.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD22HOF.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD22HOF.DP

Reader : 'READER 3'
Number data records : 34

Dependent Variable : read
Independ. Variable/s: true rda (2)
Options (PROC REG) :
Size Def. : length > 38

Model: M1
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	31.96598	15.98299	197.824	0.0001
Error	31	2.50461	0.08079		
C Total	33	34.47059			

Root MSE	0.28424	R-square	0.9273
Dep Mean	2.52941	Adj R-sq	0.9227
C.V.	11.23750		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.146313	0.20927098	-0.699	0.4897
TRUE	1	0.931452	0.04689377	19.863	0.0001
RDA	1	0.711982	0.24597212	2.895	0.0069

Regression and Tests 3

Dependent Variable: READ
Test: T_TRUE Numerator: 0.1726 DF: 1 F value: 2.1368
Denominator: 0.080794 DF: 31 Prob>F: 0.1539

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1.42857	0.64286	22.2857	37.4166	7
2	2.00000	0.61538	43.3846	0.0000	13
3	3.12500	0.62500	54.7500	11.3137	8
4	4.00000	0.50000	63.0000	0.0000	5
5	5.00000	0.50000	67.0000	.	1

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.0000	1	0.5	0.64286	1	0	12	22.2857	1
2	35.6348	2	1.0	0.64286	0	1	18	22.2857	1
3	35.6348	1	0.5	0.64286	1	0	23	22.2857	1

4	16.8331	1	0.5	0.62500	1	0	26	54.7500	3
5	0.0000	2	1.0	0.61538	0	1	33	43.3846	2
6	16.6378	1	0.5	0.61538	1	0	36	43.3846	2
7	0.0000	1	0.5	0.61538	1	0	43	43.3846	2
8	0.0000	1	0.5	0.62500	1	0	47	54.7500	3
9	0.0000	2	1.0	0.62500	0	1	54	54.7500	3
10	0.0000	1	0.5	0.50000	1	0	56	63.0000	4
11	0.0000	1	0.5	0.50000	1	0	63	63.0000	4
12	7.2524	1	0.5	0.50000	1	0	67	67.0000	5
13	31.4270	2	1.0	0.64286	0	1	19	22.2857	1
14	0.0000	1	0.5	0.64286	1	0	23	22.2857	1
15	0.0000	1	0.5	0.64286	1	0	27	22.2857	1

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.42857	1.14113	0.14113	0.28744	-0.14113	0	0
2	2	1.42857	1.49712	0.49712	-0.06855	0.50288	1	1
3	2	1.42857	1.14113	0.14113	0.28744	0.85887	1	1
4	3	3.12500	3.00403	0.00403	0.12097	-0.00403	0	0
5	2	2.00000	2.42857	0.42857	-0.42857	-0.42857	0	0
6	2	2.00000	2.07258	0.07258	-0.07258	-0.07258	0	0
7	2	2.00000	2.07258	0.07258	-0.07258	-0.07258	0	0
8	3	3.12500	3.00403	0.00403	0.12097	-0.00403	0	0
9	3	3.12500	3.36002	0.36002	-0.23502	-0.36002	0	0
10	4	4.00000	3.93548	-0.06452	0.06452	0.06452	0	0
11	4	4.00000	3.93548	-0.06452	0.06452	0.06452	0	0
12	5	5.00000	4.86694	-0.13306	0.13306	0.13306	0	0
13	2	1.42857	1.49712	0.49712	-0.06855	0.50288	1	1
14	1	1.42857	1.14113	0.14113	0.28744	-0.14113	0	0
15	1	1.42857	1.14113	0.14113	0.28744	-0.14113	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	0.84848	-0.15152	0.15152	1	0	0
2	1.53989	0.53989	0.53989	2	1	1
3	1.92208	0.92208	0.92208	2	1	1
4	2.99567	-0.00433	0.00433	3	0	0
5	1.53989	-0.46011	0.46011	2	0	0
6	1.92208	-0.07792	0.07792	2	0	0
7	1.92208	-0.07792	0.07792	2	0	0
8	2.99567	-0.00433	0.00433	3	0	0
9	2.61348	-0.38652	0.38652	3	0	0
10	4.06926	0.06926	0.06926	4	0	0
11	4.06926	0.06926	0.06926	4	0	0
12	5.14286	0.14286	0.14286	5	0	0
13	1.53989	0.53989	0.53989	2	1	1
14	0.84848	-0.15152	0.15152	1	0	0
15	0.84848	-0.15152	0.15152	1	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class

16	0.0000	2	1.0	0.61538	0	1	32	43.3846	2
17	16.6378	1	0.5	0.61538	1	0	38	43.3846	2
18	9.1240	1	0.5	0.50000	1	0	44	63.0000	4
19	20.5738	1	0.5	0.61538	1	0	51	43.3846	2
20	0.0000	2	1.0	0.61538	0	1	38	43.3846	2
21	0.0000	1	0.5	0.61538	1	0	43	43.3846	2
22	0.0000	1	0.5	0.61538	1	0	48	43.3846	2
23	0.0000	1	0.5	0.62500	1	0	52	54.7500	3
24	0.0000	1	0.5	0.62500	1	0	60	54.7500	3
25	0.0000	1	0.5	0.62500	1	0	63	54.7500	3
26	0.0000	1	0.5	0.50000	1	0	68	63.0000	4
27	15.2721	2	1.0	0.62500	0	1	75	54.7500	3
28	8.5710	1	0.5	0.50000	1	0	84	63.0000	4
29	0.0000	1	0.5	0.64286	1	0	34	22.2857	1
30	0.0000	1	0.5	0.61538	1	0	45	43.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	2	2.00000	2.42857	0.42857	-0.42857	-0.42857	0	0
17	2	2.00000	2.07258	0.07258	-0.07258	-0.07258	0	0
18	4	4.00000	3.93548	-0.06452	0.06452	0.06452	0	0
19	2	2.00000	2.07258	0.07258	-0.07258	-0.07258	0	0
20	2	2.00000	2.42857	0.42857	-0.42857	-0.42857	0	0
21	2	2.00000	2.07258	0.07258	-0.07258	-0.07258	0	0
22	2	2.00000	2.07258	0.07258	-0.07258	-0.07258	0	0
23	3	3.12500	3.00403	0.00403	0.12097	-0.00403	0	0
24	3	3.12500	3.00403	0.00403	0.12097	-0.00403	0	0
25	3	3.12500	3.00403	0.00403	0.12097	-0.00403	0	0
26	4	4.00000	3.93548	-0.06452	0.06452	0.06452	0	0
27	4	3.12500	3.36002	0.36002	-0.23502	0.63998	1	1
28	4	4.00000	3.93548	-0.06452	0.06452	0.06452	0	0
29	1	1.42857	1.14113	0.14113	0.28744	-0.14113	0	0
30	2	2.00000	2.07258	0.07258	-0.07258	-0.07258	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	1.53989	-0.46011	0.46011	2	0	0
17	1.92208	-0.07792	0.07792	2	0	0
18	4.06926	0.06926	0.06926	4	0	0
19	1.92208	-0.07792	0.07792	2	0	0
20	1.53989	-0.46011	0.46011	2	0	0
21	1.92208	-0.07792	0.07792	2	0	0
22	1.92208	-0.07792	0.07792	2	0	0
23	2.99567	-0.00433	0.00433	3	0	0
24	2.99567	-0.00433	0.00433	3	0	0
25	2.99567	-0.00433	0.00433	3	0	0
26	4.06926	0.06926	0.06926	4	0	0
27	3.68707	0.68707	0.68707	4	1	1
28	4.06926	0.06926	0.06926	4	0	0
29	0.84848	-0.15152	0.15152	1	0	0
30	1.92208	-0.07792	0.07792	2	0	0

Inverted Average

Otol. No.	Otol. Uncert.	Readability of Otol.	Readab. of Otol.	Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	0.0000	1	0.5	0.61538	1	0	49	43.3846	2
32	20.5738	1	0.5	0.61538	1	0	51	43.3846	2
33	16.6378	1	0.5	0.61538	1	0	57	43.3846	2
34	0.0000	1	0.5	0.62500	1	0	61	54.7500	3

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.00000	2.07258	0.07258	-0.07258	-0.07258	0	0
32	2	2.00000	2.07258	0.07258	-0.07258	-0.07258	0	0
33	2	2.00000	2.07258	0.07258	-0.07258	-0.07258	0	0
34	3	3.12500	3.00403	0.00403	0.12097	-0.00403	0	0
				4.00000	-0.00000	-0.00000	4	4

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	1.92208	-0.07792	0.07792	2	0	0
32	1.92208	-0.07792	0.07792	2	0	0
33	1.92208	-0.07792	0.07792	2	0	0
34	2.99567	-0.00433	0.00433	3	0	0
		-0.00000	6.35622		4	4

A G E R E A D I N G

Date - Time : 27SEP96 - 16:20:03
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD22.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD22LUN.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD22LUN.DP

Reader : 'READER 4 '
Number data records : 34

Dependent Variable : read
Independ. Variable/s: true (1)
Options (PROC REG) :
Size Def. : length > 38

Regression and Tests 2

Model: M1
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	33.89538	33.89538	416.435	0.0001
Error	32	2.60462	0.08139		
C Total	33	36.50000			

Root MSE	0.28530	R-square	0.9286
Dep Mean	2.50000	Adj R-sq	0.9264
C.V.	11.41187		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.229231	0.12155733	1.886	0.0684
TRUE	1	0.941538	0.04613862	20.407	0.0001

Regression and Tests 3

Dependent Variable: READ
Test: T_TRUE Numerator: 0.1307 DF: 1 F value: 1.6055
Denominator: 0.081394 DF: 32 Prob>F: 0.2143

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1.28571	0.5	22.2857	37.9517	7
2	2.00000	0.5	43.3846	0.0000	13
3	3.12500	0.5	54.7500	11.3137	8
4	4.00000	0.5	63.0000	0.0000	5
5	5.00000	1.0	67.0000	.	1

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Average Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.0000	1	0.5	0.5	1	0	12	22.2857	1
2	35.6348	1	0.5	0.5	1	0	18	22.2857	1
3	35.6348	1	0.5	0.5	1	0	23	22.2857	1
4	16.8331	1	0.5	0.5	1	0	26	54.7500	3
5	0.0000	1	0.5	0.5	1	0	33	43.3846	2
6	16.6378	1	0.5	0.5	1	0	36	43.3846	2

7	0.0000	1	0.5	0.5	1	0	43	43.3846	2
8	0.0000	1	0.5	0.5	1	0	47	54.7500	3
9	0.0000	1	0.5	0.5	1	0	54	54.7500	3
10	0.0000	1	0.5	0.5	1	0	56	63.0000	4
11	0.0000	1	0.5	0.5	1	0	63	63.0000	4
12	7.2524	2	1.0	1.0	0	1	67	67.0000	5
13	31.4270	1	0.5	0.5	1	0	19	22.2857	1
14	0.0000	1	0.5	0.5	1	0	23	22.2857	1
15	0.0000	1	0.5	0.5	1	0	27	22.2857	1

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Read Age - Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.28571	1.17077	0.17077	0.11495	-0.17077	0	0
2	2	1.28571	1.17077	0.17077	0.11495	0.82923	1	1
3	2	1.28571	1.17077	0.17077	0.11495	0.82923	1	1
4	3	3.12500	3.05385	0.05385	0.07115	-0.05385	0	0
5	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0
6	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0
7	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0
8	3	3.12500	3.05385	0.05385	0.07115	-0.05385	0	0
9	3	3.12500	3.05385	0.05385	0.07115	-0.05385	0	0
10	4	4.00000	3.99538	-0.00462	0.00462	0.00462	0	0
11	4	4.00000	3.99538	-0.00462	0.00462	0.00462	0	0
12	5	5.00000	4.93692	-0.06308	0.06308	0.06308	0	0
13	1	1.28571	1.17077	0.17077	0.11495	-0.17077	0	0
14	1	1.28571	1.17077	0.17077	0.11495	-0.17077	0	0
15	1	1.28571	1.17077	0.17077	0.11495	-0.17077	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	0.81863	-0.18137	0.18137	1	0	0
2	1.88072	0.88072	0.88072	2	1	1
3	1.88072	0.88072	0.88072	2	1	1
4	2.94281	-0.05719	0.05719	3	0	0
5	1.88072	-0.11928	0.11928	2	0	0
6	1.88072	-0.11928	0.11928	2	0	0
7	1.88072	-0.11928	0.11928	2	0	0
8	2.94281	-0.05719	0.05719	3	0	0
9	2.94281	-0.05719	0.05719	3	0	0
10	4.00490	0.00490	0.00490	4	0	0
11	4.00490	0.00490	0.00490	4	0	0
12	5.06699	0.06699	0.06699	5	0	0
13	0.81863	-0.18137	0.18137	1	0	0
14	0.81863	-0.18137	0.18137	1	0	0
15	0.81863	-0.18137	0.18137	1	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Average Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	0.0000	1	0.5	0.5	1	0	32	43.3846	2
17	16.6378	1	0.5	0.5	1	0	38	43.3846	2

18	9.1240	1	0.5	0.5	1	0	44	63.0000	4
19	20.5738	1	0.5	0.5	1	0	51	43.3846	2
20	0.0000	1	0.5	0.5	1	0	38	43.3846	2
21	0.0000	1	0.5	0.5	1	0	43	43.3846	2
22	0.0000	1	0.5	0.5	1	0	48	43.3846	2
23	0.0000	1	0.5	0.5	1	0	52	54.7500	3
24	0.0000	1	0.5	0.5	1	0	60	54.7500	3
25	0.0000	1	0.5	0.5	1	0	63	54.7500	3
26	0.0000	1	0.5	0.5	1	0	68	63.0000	4
27	15.2721	1	0.5	0.5	1	0	75	54.7500	3
28	8.5710	1	0.5	0.5	1	0	84	63.0000	4
29	0.0000	1	0.5	0.5	1	0	34	22.2857	1
30	0.0000	1	0.5	0.5	1	0	45	43.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0
17	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0
18	4	4.00000	3.99538	-0.00462	0.00462	0.00462	0	0
19	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0
20	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0
21	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0
22	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0
23	3	3.12500	3.05385	0.05385	0.07115	-0.05385	0	0
24	3	3.12500	3.05385	0.05385	0.07115	-0.05385	0	0
25	3	3.12500	3.05385	0.05385	0.07115	-0.05385	0	0
26	4	4.00000	3.99538	-0.00462	0.00462	0.00462	0	0
27	4	3.12500	3.05385	0.05385	0.07115	0.94615	1	1
28	4	4.00000	3.99538	-0.00462	0.00462	0.00462	0	0
29	1	1.28571	1.17077	0.17077	0.11495	-0.17077	0	0
30	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	1.88072	-0.11928	0.11928	2	0	0
17	1.88072	-0.11928	0.11928	2	0	0
18	4.00490	0.00490	0.00490	4	0	0
19	1.88072	-0.11928	0.11928	2	0	0
20	1.88072	-0.11928	0.11928	2	0	0
21	1.88072	-0.11928	0.11928	2	0	0
22	1.88072	-0.11928	0.11928	2	0	0
23	2.94281	-0.05719	0.05719	3	0	0
24	2.94281	-0.05719	0.05719	3	0	0
25	2.94281	-0.05719	0.05719	3	0	0
26	4.00490	0.00490	0.00490	4	0	0
27	4.00490	1.00490	1.00490	4	1	1
28	4.00490	0.00490	0.00490	4	0	0
29	0.81863	-0.18137	0.18137	1	0	0
30	1.88072	-0.11928	0.11928	2	0	0

Estim. of means, biases and dispersion 7

Otol.	Otol.	Readability of	Inverted Readab. of	Average Readab. of	Good	Worse	Fish	Average Fish	True Age

No.	Uncert.	Otol.	Otol.	Otol.	Readab.	Readab.	Length	Length	Class
31	0.0000	1	0.5	0.5	1	0	49	43.3846	2
32	20.5738	1	0.5	0.5	1	0	51	43.3846	2
33	16.6378	1	0.5	0.5	1	0	57	43.3846	2
34	0.0000	1	0.5	0.5	1	0	61	54.7500	3

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0
32	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0
33	2	2.00000	2.11231	0.11231	-0.11231	-0.11231	0	0
34	3	3.12500	3.05385	0.05385	0.07115	-0.05385	0	0
				3.00000	-0.00000	-0.00000	3	3

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	1.88072	-0.11928	0.11928	2	0	0
32	1.88072	-0.11928	0.11928	2	0	0
33	1.88072	-0.11928	0.11928	2	0	0
34	2.94281	-0.05719	0.05719	3	0	0
		-0.00000	5.71569		3	3

A G E R E A D I N G

Date - Time : 27SEP96 - 16:20:18
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD22.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD22POU.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD22POU.DP

Reader : 'READER 5 '
Number data records : 34

Dependent Variable : read
Independ. Variable/s: true (1)
Options (PROC REG) : noint
Size Def. : length > 38

Regression and Tests 2

Model: M1
NOTE: No intercept in model. R-square is redefined.

Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	236.00000	236.00000	.	.
Error	33	0	0		
U Total	34	236.00000			

Root MSE	0.00000	R-square	1.0000
Dep Mean	2.41176	Adj R-sq	1.0000
C.V.	0.00000		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
TRUE	1	1.000000	0.00000000	.	.

Regression and Tests 3

Dependent Variable: READ

Test: T_TRUE	Numerator:	0.0000	DF:	1	F value:	.
	Denominator:	0	DF:	33	Prob>F:	.

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1	0.5	22.2857	0	7
2	2	0.5	43.3846	0	13
3	3	0.5	54.7500	0	8
4	4	0.5	63.0000	0	5
5	5	0.5	67.0000	.	1

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Average Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length
1	0.0000	1	0.5	0.5	1	0	12	22.2857
2	35.6348	1	0.5	0.5	1	0	18	22.2857
3	35.6348	1	0.5	0.5	1	0	23	22.2857
4	16.8331	1	0.5	0.5	1	0	26	54.7500
5	0.0000	1	0.5	0.5	1	0	33	43.3846
6	16.6378	1	0.5	0.5	1	0	36	43.3846
7	0.0000	1	0.5	0.5	1	0	43	43.3846
8	0.0000	1	0.5	0.5	1	0	47	54.7500

9	0.0000	1	0.5	0.5	1	0	54	54.7500
10	0.0000	1	0.5	0.5	1	0	56	63.0000
11	0.0000	1	0.5	0.5	1	0	63	63.0000
12	7.2524	1	0.5	0.5	1	0	67	67.0000
13	31.4270	1	0.5	0.5	1	0	19	22.2857
14	0.0000	1	0.5	0.5	1	0	23	22.2857
15	0.0000	1	0.5	0.5	1	0	27	22.2857

Otol. No.	True Age Class	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1	1	1	0	0	0	0	0
2	1	1	1	1	0	0	0	0	0
3	1	1	1	1	0	0	0	0	0
4	3	3	3	3	0	0	0	0	0
5	2	2	2	2	0	0	0	0	0
6	2	2	2	2	0	0	0	0	0
7	2	2	2	2	0	0	0	0	0
8	3	3	3	3	0	0	0	0	0
9	3	3	3	3	0	0	0	0	0
10	4	4	4	4	0	0	0	0	0
11	4	4	4	4	0	0	0	0	0
12	5	5	5	5	0	0	0	0	0
13	1	1	1	1	0	0	0	0	0
14	1	1	1	1	0	0	0	0	0
15	1	1	1	1	0	0	0	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	1	0	0	1	0	0
2	1	0	0	1	0	0
3	1	0	0	1	0	0
4	3	0	0	3	0	0
5	2	0	0	2	0	0
6	2	0	0	2	0	0
7	2	0	0	2	0	0
8	3	0	0	3	0	0
9	3	0	0	3	0	0
10	4	0	0	4	0	0
11	4	0	0	4	0	0
12	5	0	0	5	0	0
13	1	0	0	1	0	0
14	1	0	0	1	0	0
15	1	0	0	1	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length
16	0.0000	1	0.5	0.5	1	0	32	43.3846
17	16.6378	1	0.5	0.5	1	0	38	43.3846
18	9.1240	1	0.5	0.5	1	0	44	63.0000
19	20.5738	1	0.5	0.5	1	0	51	43.3846

20	0.0000	1	0.5	0.5	1	0	38	43.3846
21	0.0000	1	0.5	0.5	1	0	43	43.3846
22	0.0000	1	0.5	0.5	1	0	48	43.3846
23	0.0000	1	0.5	0.5	1	0	52	54.7500
24	0.0000	1	0.5	0.5	1	0	60	54.7500
25	0.0000	1	0.5	0.5	1	0	63	54.7500
26	0.0000	1	0.5	0.5	1	0	68	63.0000
27	15.2721	1	0.5	0.5	1	0	75	54.7500
28	8.5710	1	0.5	0.5	1	0	84	63.0000
29	0.0000	1	0.5	0.5	1	0	34	22.2857
30	0.0000	1	0.5	0.5	1	0	45	43.3846

Otol. No.	True Age Class	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	2	2	2	2	0	0	0	0	0
17	2	2	2	2	0	0	0	0	0
18	4	4	4	4	0	0	0	0	0
19	2	2	2	2	0	0	0	0	0
20	2	2	2	2	0	0	0	0	0
21	2	2	2	2	0	0	0	0	0
22	2	2	2	2	0	0	0	0	0
23	3	3	3	3	0	0	0	0	0
24	3	3	3	3	0	0	0	0	0
25	3	3	3	3	0	0	0	0	0
26	4	4	4	4	0	0	0	0	0
27	3	3	3	3	0	0	0	0	0
28	4	4	4	4	0	0	0	0	0
29	1	1	1	1	0	0	0	0	0
30	2	2	2	2	0	0	0	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	2	0	0	2	0	0
17	2	0	0	2	0	0
18	4	0	0	4	0	0
19	2	0	0	2	0	0
20	2	0	0	2	0	0
21	2	0	0	2	0	0
22	2	0	0	2	0	0
23	3	0	0	3	0	0
24	3	0	0	3	0	0
25	3	0	0	3	0	0
26	4	0	0	4	0	0
27	3	0	0	3	0	0
28	4	0	0	4	0	0
29	1	0	0	1	0	0
30	2	0	0	2	0	0

Estim. of means, biases and dispersion 7

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Average Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length

31	0.0000	1	0.5	0.5	1	0	49	43.3846
32	20.5738	1	0.5	0.5	1	0	51	43.3846
33	16.6378	1	0.5	0.5	1	0	57	43.3846
34	0.0000	1	0.5	0.5	1	0	61	54.7500

Otol. No.	True Age Class	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2	2	2	0	0	0	0	0
32	2	2	2	2	0	0	0	0	0
33	2	2	2	2	0	0	0	0	0
34	3	3	3	3	0	0	0	0	0
					0	0	0	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	2	0	0	2	0	0
32	2	0	0	2	0	0
33	2	0	0	2	0	0
34	3	0	0	3	0	0
		0	0		0	0

A G E R E A D I N G

Date - Time : 27SEP96 - 16:20:33
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD22.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD22SJO.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD22SJO.DP

Reader : 'READER 6'
Number data records : 34

Dependent Variable : read
Independ. Variable/s: true length (2)
Options (PROC REG) :
Size Def. : length > 38

Regression and Tests 2

Model: M1
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	38.87708	19.43854	378.155	0.0001
Error	31	1.59351	0.05140		
C Total	33	40.47059			

Root MSE	0.22672	R-square	0.9606
Dep Mean	2.47059	Adj R-sq	0.9581
C.V.	9.17691		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.083194	0.11130656	-0.747	0.4604
TRUE	1	0.895964	0.05874750	15.251	0.0001
LENGTH	1	0.008675	0.00366483	2.367	0.0244

Regression and Tests 3

Dependent Variable: READ

Test: T_TRUE	Numerator:	0.1612	DF:	1	F value:	3.1361
	Denominator:	0.051404	DF:	31	Prob>F:	0.0864

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1.00000	0.50000	22.2857	0.0000	7
2	2.07692	0.61538	43.3846	13.3539	13
3	3.12500	0.50000	54.7500	11.3137	8
4	4.00000	0.60000	63.0000	0.0000	5
5	5.00000	0.50000	67.0000	.	1

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.0000	1	0.5	0.50000	1	0	12	22.2857	1
2	35.6348	1	0.5	0.50000	1	0	18	22.2857	1
3	35.6348	1	0.5	0.50000	1	0	23	22.2857	1
4	16.8331	1	0.5	0.50000	1	0	26	54.7500	3
5	0.0000	1	0.5	0.61538	1	0	33	43.3846	2
6	16.6378	1	0.5	0.61538	1	0	36	43.3846	2
7	0.0000	1	0.5	0.61538	1	0	43	43.3846	2
8	0.0000	1	0.5	0.50000	1	0	47	54.7500	3

9	0.0000	1	0.5	0.50000	1	0	54	54.7500	3
10	0.0000	1	0.5	0.60000	1	0	56	63.0000	4
11	0.0000	1	0.5	0.60000	1	0	63	63.0000	4
12	7.2524	1	0.5	0.50000	1	0	67	67.0000	5
13	31.4270	1	0.5	0.50000	1	0	19	22.2857	1
14	0.0000	1	0.5	0.50000	1	0	23	22.2857	1
15	0.0000	1	0.5	0.50000	1	0	27	22.2857	1

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.00000	0.91687	-0.08313	0.08313	0.08313	0	0
2	1	1.00000	0.96892	-0.03108	0.03108	0.03108	0	0
3	1	1.00000	1.01230	0.01230	-0.01230	-0.01230	0	0
4	3	3.12500	2.83025	-0.16975	0.29475	0.16975	0	0
5	2	2.07692	1.99501	-0.00499	0.08191	0.00499	0	0
6	2	2.07692	2.02104	0.02104	0.05589	-0.02104	0	0
7	2	2.07692	2.08176	0.08176	-0.00484	-0.08176	0	0
8	3	3.12500	3.01242	0.01242	0.11258	-0.01242	0	0
9	3	3.12500	3.07315	0.07315	0.05185	-0.07315	0	0
10	4	4.00000	3.98646	-0.01354	0.01354	0.01354	0	0
11	4	4.00000	4.04719	0.04719	-0.04719	-0.04719	0	0
12	5	5.00000	4.97785	-0.02215	0.02215	0.02215	0	0
13	1	1.00000	0.97760	-0.02240	0.02240	0.02240	0	0
14	1	1.00000	1.01230	0.01230	-0.01230	-0.01230	0	0
15	1	1.00000	1.04700	0.04700	-0.04700	-0.04700	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	1.09278	0.09278	0.09278	1	0	0
2	1.03469	0.03469	0.03469	1	0	0
3	0.98628	-0.01372	0.01372	1	0	0
4	3.18946	0.18946	0.18946	3	0	0
5	2.00557	0.00557	0.00557	2	0	0
6	1.97652	-0.02348	0.02348	2	0	0
7	1.90875	-0.09125	0.09125	2	0	0
8	2.98613	-0.01387	0.01387	3	0	0
9	2.91836	-0.08164	0.08164	3	0	0
10	4.01511	0.01511	0.01511	4	0	0
11	3.94733	-0.05267	0.05267	4	0	0
12	5.02472	0.02472	0.02472	5	0	0
13	1.02501	0.02501	0.02501	1	0	0
14	0.98628	-0.01372	0.01372	1	0	0
15	0.94755	-0.05245	0.05245	1	0	0

Estim. of means, biases and dispersion 6

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	0.0000	1	0.5	0.61538	1	0	32	43.3846	2
17	16.6378	1	0.5	0.61538	1	0	38	43.3846	2
18	9.1240	1	0.5	0.60000	1	0	44	63.0000	4
19	20.5738	2	1.0	0.61538	0	1	51	43.3846	2

20	0.0000	1	0.5	0.61538	1	0	38	43.3846	2
21	0.0000	1	0.5	0.61538	1	0	43	43.3846	2
22	0.0000	1	0.5	0.61538	1	0	48	43.3846	2
23	0.0000	1	0.5	0.50000	1	0	52	54.7500	3
24	0.0000	1	0.5	0.50000	1	0	60	54.7500	3
25	0.0000	1	0.5	0.50000	1	0	63	54.7500	3
26	0.0000	1	0.5	0.60000	1	0	68	63.0000	4
27	15.2721	1	0.5	0.50000	1	0	75	54.7500	3
28	8.5710	2	1.0	0.60000	0	1	84	63.0000	4
29	0.0000	1	0.5	0.50000	1	0	34	22.2857	1
30	0.0000	1	0.5	0.61538	1	0	45	43.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	2	2.07692	1.98633	-0.01367	0.09059	0.01367	0	0
17	2	2.07692	2.03839	0.03839	0.03854	-0.03839	0	0
18	4	4.00000	3.88236	-0.11764	0.11764	0.11764	0	0
19	2	2.07692	2.15116	0.15116	-0.07424	-0.15116	0	0
20	2	2.07692	2.03839	0.03839	0.03854	-0.03839	0	0
21	2	2.07692	2.08176	0.08176	-0.00484	-0.08176	0	0
22	2	2.07692	2.12514	0.12514	-0.04821	-0.12514	0	0
23	3	3.12500	3.05580	0.05580	0.06920	-0.05580	0	0
24	3	3.12500	3.12520	0.12520	-0.00020	-0.12520	0	0
25	3	3.12500	3.15123	0.15123	-0.02623	-0.15123	0	0
26	4	4.00000	4.09056	0.09056	-0.09056	-0.09056	0	0
27	4	3.12500	3.25533	0.25533	-0.13033	0.74467	1	1
28	4	4.00000	4.22937	0.22937	-0.22937	-0.22937	0	0
29	1	1.00000	1.10772	0.10772	-0.10772	-0.10772	0	0
30	2	2.07692	2.09911	0.09911	-0.02219	-0.09911	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	2.01525	0.01525	0.01525	2	0	0
17	1.95716	-0.04284	0.04284	2	0	0
18	4.13130	0.13130	0.13130	4	0	0
19	1.83129	-0.16871	0.16871	2	0	0
20	1.95716	-0.04284	0.04284	2	0	0
21	1.90875	-0.09125	0.09125	2	0	0
22	1.86033	-0.13967	0.13967	2	0	0
23	2.93772	-0.06228	0.06228	3	0	0
24	2.86026	-0.13974	0.13974	3	0	0
25	2.83122	-0.16878	0.16878	3	0	0
26	3.89892	-0.10108	0.10108	4	0	0
27	3.83114	0.83114	0.83114	4	1	1
28	3.74400	-0.25600	0.25600	4	0	0
29	0.87977	-0.12023	0.12023	1	0	0
30	1.88938	-0.11062	0.11062	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Average Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class

31	0.0000	1	0.5	0.61538	1	0	49	43.3846	2
32	20.5738	2	1.0	0.61538	0	1	51	43.3846	2
33	16.6378	2	1.0	0.61538	0	1	57	43.3846	2
34	0.0000	1	0.5	0.50000	1	0	61	54.7500	3

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.07692	2.13381	0.13381	-0.05689	-0.13381	0	0
32	3	2.07692	2.15116	0.15116	-0.07424	0.84884	1	1
33	2	2.07692	2.20321	0.20321	-0.12629	-0.20321	0	0
34	3	3.12500	3.13388	0.13388	-0.00888	-0.13388	0	0
				2.00000	-0.00000	-0.00000	2	2

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	1.85065	-0.14935	0.14935	2	0	0
32	2.94740	0.94740	0.94740	3	1	1
33	1.77319	-0.22681	0.22681	2	0	0
34	2.85058	-0.14942	0.14942	3	0	0
		-0.00000	4.62487		2	2

A G E R E A D I N G

Date - Time : 27SEP96 - 16:20:48
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD22.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD22ULR.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD22ULR.DP

Reader : 'READER 7 '
Number data records : 34

Dependent Variable : read
Independ. Variable/s: true (1)
Options (PROC REG) :
Size Def. : length > 38

Regression and Tests 2

Model: M1
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	30.23385	30.23385	226.781	0.0001
Error	32	4.26615	0.13332		
C Total	33	34.50000			

Root MSE	0.36513	R-square	0.8763
Dep Mean	2.50000	Adj R-sq	0.8725
C.V.	14.60506		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.355385	0.15557062	2.284	0.0291
TRUE	1	0.889231	0.05904880	15.059	0.0001

Regression and Tests 3

Dependent Variable: READ

Test: T_TRUE	Numerator:	0.4691	DF:	1	F value:	3.5190
	Denominator:	0.133317	DF:	32	Prob>F:	0.0698

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1.28571	0.50000	22.2857	37.9517	7
2	2.15385	0.57692	43.3846	17.4355	13
3	2.87500	0.50000	54.7500	12.2975	8
4	4.00000	0.50000	63.0000	0.0000	5
5	5.00000	1.00000	67.0000	.	1

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.0000	1	0.5	0.50000	1	0	12	22.2857	1
2	35.6348	1	0.5	0.50000	1	0	18	22.2857	1
3	35.6348	1	0.5	0.50000	1	0	23	22.2857	1
4	16.8331	1	0.5	0.50000	1	0	26	54.7500	3
5	0.0000	1	0.5	0.57692	1	0	33	43.3846	2
6	16.6378	1	0.5	0.57692	1	0	36	43.3846	2
7	0.0000	1	0.5	0.57692	1	0	43	43.3846	2
8	0.0000	1	0.5	0.50000	1	0	47	54.7500	3
9	0.0000	1	0.5	0.50000	1	0	54	54.7500	3

10	0.0000	1	0.5	0.50000	1	0	56	63.0000	4
11	0.0000	1	0.5	0.50000	1	0	63	63.0000	4
12	7.2524	2	1.0	1.00000	0	1	67	67.0000	5
13	31.4270	1	0.5	0.50000	1	0	19	22.2857	1
14	0.0000	1	0.5	0.50000	1	0	23	22.2857	1
15	0.0000	1	0.5	0.50000	1	0	27	22.2857	1

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.28571	1.24462	0.24462	0.04110	-0.24462	0	0
2	2	1.28571	1.24462	0.24462	0.04110	0.75538	1	1
3	2	1.28571	1.24462	0.24462	0.04110	0.75538	1	1
4	2	2.87500	3.02308	0.02308	-0.14808	-1.02308	-1	1
5	2	2.15385	2.13385	0.13385	0.02000	-0.13385	0	0
6	3	2.15385	2.13385	0.13385	0.02000	0.86615	1	1
7	2	2.15385	2.13385	0.13385	0.02000	-0.13385	0	0
8	3	2.87500	3.02308	0.02308	-0.14808	-0.02308	0	0
9	3	2.87500	3.02308	0.02308	-0.14808	-0.02308	0	0
10	4	4.00000	3.91231	-0.08769	0.08769	0.08769	0	0
11	4	4.00000	3.91231	-0.08769	0.08769	0.08769	0	0
12	5	5.00000	4.80154	-0.19846	0.19846	0.19846	0	0
13	1	1.28571	1.24462	0.24462	0.04110	-0.24462	0	0
14	1	1.28571	1.24462	0.24462	0.04110	-0.24462	0	0
15	1	1.28571	1.24462	0.24462	0.04110	-0.24462	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	0.72491	-0.27509	0.27509	1	0	0
2	1.84948	0.84948	0.84948	2	1	1
3	1.84948	0.84948	0.84948	2	1	1
4	1.84948	-1.15052	1.15052	2	-1	1
5	1.84948	-0.15052	0.15052	2	0	0
6	2.97405	0.97405	0.97405	3	1	1
7	1.84948	-0.15052	0.15052	2	0	0
8	2.97405	-0.02595	0.02595	3	0	0
9	2.97405	-0.02595	0.02595	3	0	0
10	4.09862	0.09862	0.09862	4	0	0
11	4.09862	0.09862	0.09862	4	0	0
12	5.22318	0.22318	0.22318	5	0	0
13	0.72491	-0.27509	0.27509	1	0	0
14	0.72491	-0.27509	0.27509	1	0	0
15	0.72491	-0.27509	0.27509	1	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	0.0000	2	1.0	0.57692	0	1	32	43.3846	2
17	16.6378	1	0.5	0.57692	1	0	38	43.3846	2
18	9.1240	1	0.5	0.50000	1	0	44	63.0000	4
19	20.5738	2	1.0	0.57692	0	1	51	43.3846	2
20	0.0000	1	0.5	0.57692	1	0	38	43.3846	2

21	0.0000	1	0.5	0.57692	1	0	43	43.3846	2
22	0.0000	1	0.5	0.57692	1	0	48	43.3846	2
23	0.0000	1	0.5	0.50000	1	0	52	54.7500	3
24	0.0000	1	0.5	0.50000	1	0	60	54.7500	3
25	0.0000	1	0.5	0.50000	1	0	63	54.7500	3
26	0.0000	1	0.5	0.50000	1	0	68	63.0000	4
27	15.2721	1	0.5	0.50000	1	0	75	54.7500	3
28	8.5710	1	0.5	0.50000	1	0	84	63.0000	4
29	0.0000	1	0.5	0.50000	1	0	34	22.2857	1
30	0.0000	1	0.5	0.57692	1	0	45	43.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	2	2.15385	2.13385	0.13385	0.02000	-0.13385	0	0
17	2	2.15385	2.13385	0.13385	0.02000	-0.13385	0	0
18	4	4.00000	3.91231	-0.08769	0.08769	0.08769	0	0
19	3	2.15385	2.13385	0.13385	0.02000	0.86615	1	1
20	2	2.15385	2.13385	0.13385	0.02000	-0.13385	0	0
21	2	2.15385	2.13385	0.13385	0.02000	-0.13385	0	0
22	2	2.15385	2.13385	0.13385	0.02000	-0.13385	0	0
23	3	2.87500	3.02308	0.02308	-0.14808	-0.02308	0	0
24	3	2.87500	3.02308	0.02308	-0.14808	-0.02308	0	0
25	3	2.87500	3.02308	0.02308	-0.14808	-0.02308	0	0
26	4	4.00000	3.91231	-0.08769	0.08769	0.08769	0	0
27	3	2.87500	3.02308	0.02308	-0.14808	-0.02308	0	0
28	4	4.00000	3.91231	-0.08769	0.08769	0.08769	0	0
29	1	1.28571	1.24462	0.24462	0.04110	-0.24462	0	0
30	2	2.15385	2.13385	0.13385	0.02000	-0.13385	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	1.84948	-0.15052	0.15052	2	0	0
17	1.84948	-0.15052	0.15052	2	0	0
18	4.09862	0.09862	0.09862	4	0	0
19	2.97405	0.97405	0.97405	3	1	1
20	1.84948	-0.15052	0.15052	2	0	0
21	1.84948	-0.15052	0.15052	2	0	0
22	1.84948	-0.15052	0.15052	2	0	0
23	2.97405	-0.02595	0.02595	3	0	0
24	2.97405	-0.02595	0.02595	3	0	0
25	2.97405	-0.02595	0.02595	3	0	0
26	4.09862	0.09862	0.09862	4	0	0
27	2.97405	-0.02595	0.02595	3	0	0
28	4.09862	0.09862	0.09862	4	0	0
29	0.72491	-0.27509	0.27509	1	0	0
30	1.84948	-0.15052	0.15052	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	0.0000	1	0.5	0.57692	1	0	49	43.3846	2

32	20.5738	1	0.5	0.57692	1	0	51	43.3846	2
33	16.6378	1	0.5	0.57692	1	0	57	43.3846	2
34	0.0000	1	0.5	0.50000	1	0	61	54.7500	3

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.15385	2.13385	0.13385	0.02000	-0.13385	0	0
32	2	2.15385	2.13385	0.13385	0.02000	-0.13385	0	0
33	2	2.15385	2.13385	0.13385	0.02000	-0.13385	0	0
34	3	2.87500	3.02308	0.02308	-0.14808	-0.02308	0	0
				3.00000	-0.00000	-0.00000	3	5

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	1.84948	-0.15052	0.15052	2	0	0
32	1.84948	-0.15052	0.15052	2	0	0
33	1.84948	-0.15052	0.15052	2	0	0
34	2.97405	-0.02595	0.02595	3	0	0
		-0.00000	8.72664		3	5

A G E R E A D I N G

Date - Time : 27SEP96 - 16:21:03
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD22.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD22WAL.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD22WAL.DP

Reader : 'READER 8 '
Number data records : 34

Dependent Variable : read
Independ. Variable/s: true length (2)
Options (PROC REG) :
Size Def. : length > 38

Regression and Tests 2

Model: M1
Dependent Variable: READ

Analysis of Variance

Sum of Mean

Source	DF	Squares	Square	F Value	Prob>F
Model	2	34.13466	17.06733	279.239	0.0001
Error	31	1.89475	0.06112		
C Total	33	36.02941			

Root MSE	0.24723	R-square	0.9474
Dep Mean	2.38235	Adj R-sq	0.9440
C.V.	10.37740		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.097603	0.12137204	-0.804	0.4274
TRUE	1	0.740177	0.06406005	11.554	0.0001
LENGTH	1	0.015340	0.00399624	3.839	0.0006

Regression and Tests 3

Dependent Variable: READ

Test: T_TRUE Numerator: 1.0055 DF: 1 F value: 16.4505
Denominator: 0.061121 DF: 31 Prob>F: 0.0003

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1.00000	0.5	22.2857	0.0000	7
2	2.07692	0.5	43.3846	13.3539	13
3	2.87500	0.5	54.7500	12.2975	8
4	3.80000	0.5	63.0000	11.7688	5
5	5.00000	0.5	67.0000	.	1

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Average Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.0000	1	0.5	0.5	1	0	12	22.2857	1
2	35.6348	1	0.5	0.5	1	0	18	22.2857	1
3	35.6348	1	0.5	0.5	1	0	23	22.2857	1
4	16.8331	1	0.5	0.5	1	0	26	54.7500	3
5	0.0000	1	0.5	0.5	1	0	33	43.3846	2
6	16.6378	1	0.5	0.5	1	0	36	43.3846	2
7	0.0000	1	0.5	0.5	1	0	43	43.3846	2
8	0.0000	1	0.5	0.5	1	0	47	54.7500	3
9	0.0000	1	0.5	0.5	1	0	54	54.7500	3
10	0.0000	1	0.5	0.5	1	0	56	63.0000	4

11	0.0000	1	0.5	0.5	1	0	63	63.0000	4
12	7.2524	1	0.5	0.5	1	0	67	67.0000	5
13	31.4270	1	0.5	0.5	1	0	19	22.2857	1
14	0.0000	1	0.5	0.5	1	0	23	22.2857	1
15	0.0000	1	0.5	0.5	1	0	27	22.2857	1

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.00000	0.82666	-0.17334	0.17334	0.17334	0	0
2	1	1.00000	0.91870	-0.08130	0.08130	0.08130	0	0
3	1	1.00000	0.99540	-0.00460	0.00460	0.00460	0	0
4	2	2.87500	2.52178	-0.47822	0.35322	-0.52178	-1	1
5	2	2.07692	1.88898	-0.11102	0.18794	0.11102	0	0
6	2	2.07692	1.93500	-0.06500	0.14192	0.06500	0	0
7	2	2.07692	2.04238	0.04238	0.03454	-0.04238	0	0
8	3	2.87500	2.84392	-0.15608	0.03108	0.15608	0	0
9	3	2.87500	2.95130	-0.04870	-0.07630	0.04870	0	0
10	4	3.80000	3.72216	-0.27784	0.07784	0.27784	0	0
11	4	3.80000	3.82954	-0.17046	-0.02954	0.17046	0	0
12	5	5.00000	4.63108	-0.36892	0.36892	0.36892	0	0
13	1	1.00000	0.93404	-0.06596	0.06596	0.06596	0	0
14	1	1.00000	0.99540	-0.00460	0.00460	0.00460	0	0
15	1	1.00000	1.05676	0.05676	-0.05676	-0.05676	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	1.23419	0.23419	0.23419	1	0	0
2	1.10984	0.10984	0.10984	1	0	0
3	1.00621	0.00621	0.00621	1	0	0
4	2.29507	-0.70493	0.70493	2	-1	1
5	2.14999	0.14999	0.14999	2	0	0
6	2.08782	0.08782	0.08782	2	0	0
7	1.94274	-0.05726	0.05726	2	0	0
8	3.21087	0.21087	0.21087	3	0	0
9	3.06579	0.06579	0.06579	3	0	0
10	4.37537	0.37537	0.37537	4	0	0
11	4.23030	0.23030	0.23030	4	0	0
12	5.49842	0.49842	0.49842	5	0	0
13	1.08912	0.08912	0.08912	1	0	0
14	1.00621	0.00621	0.00621	1	0	0
15	0.92331	-0.07669	0.07669	1	0	0

Estim. of means, biases and dispersion 6

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	0.0000	1	0.5	0.5	1	0	32	43.3846	2
17	16.6378	1	0.5	0.5	1	0	38	43.3846	2
18	9.1240	1	0.5	0.5	1	0	44	63.0000	4
19	20.5738	1	0.5	0.5	1	0	51	43.3846	2
20	0.0000	1	0.5	0.5	1	0	38	43.3846	2
21	0.0000	1	0.5	0.5	1	0	43	43.3846	2

22	0.0000	1	0.5	0.5	1	0	48	43.3846	2
23	0.0000	1	0.5	0.5	1	0	52	54.7500	3
24	0.0000	1	0.5	0.5	1	0	60	54.7500	3
25	0.0000	1	0.5	0.5	1	0	63	54.7500	3
26	0.0000	1	0.5	0.5	1	0	68	63.0000	4
27	15.2721	1	0.5	0.5	1	0	75	54.7500	3
28	8.5710	1	0.5	0.5	1	0	84	63.0000	4
29	0.0000	1	0.5	0.5	1	0	34	22.2857	1
30	0.0000	1	0.5	0.5	1	0	45	43.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	2	2.07692	1.87364	-0.12636	0.20328	0.12636	0	0
17	2	2.07692	1.96568	-0.03432	0.11124	0.03432	0	0
18	3	3.80000	3.53808	-0.46192	0.26192	-0.53808	-1	1
19	3	2.07692	2.16510	0.16510	-0.08818	0.83490	1	1
20	2	2.07692	1.96568	-0.03432	0.11124	0.03432	0	0
21	2	2.07692	2.04238	0.04238	0.03454	-0.04238	0	0
22	2	2.07692	2.11908	0.11908	-0.04216	-0.11908	0	0
23	3	2.87500	2.92062	-0.07938	-0.04562	0.07938	0	0
24	3	2.87500	3.04334	0.04334	-0.16834	-0.04334	0	0
25	3	2.87500	3.08936	0.08936	-0.21436	-0.08936	0	0
26	4	3.80000	3.90624	-0.09376	-0.10624	0.09376	0	0
27	3	2.87500	3.27345	0.27345	-0.39845	-0.27345	0	0
28	4	3.80000	4.15169	0.15169	-0.35169	-0.15169	0	0
29	1	1.00000	1.16414	0.16414	-0.16414	-0.16414	0	0
30	2	2.07692	2.07306	0.07306	0.00386	-0.07306	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	2.17072	0.17072	0.17072	2	0	0
17	2.04637	0.04637	0.04637	2	0	0
18	3.27304	-0.72696	0.72696	3	-1	1
19	3.12797	1.12797	1.12797	3	1	1
20	2.04637	0.04637	0.04637	2	0	0
21	1.94274	-0.05726	0.05726	2	0	0
22	1.83912	-0.16088	0.16088	2	0	0
23	3.10724	0.10724	0.10724	3	0	0
24	2.94144	-0.05856	0.05856	3	0	0
25	2.87927	-0.12073	0.12073	3	0	0
26	4.12667	0.12667	0.12667	4	0	0
27	2.63057	-0.36943	0.36943	3	0	0
28	3.79507	-0.20493	0.20493	4	0	0
29	0.77824	-0.22176	0.22176	1	0	0
30	1.90129	-0.09871	0.09871	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	0.0000	1	0.5	0.5	1	0	49	43.3846	2
32	20.5738	1	0.5	0.5	1	0	51	43.3846	2

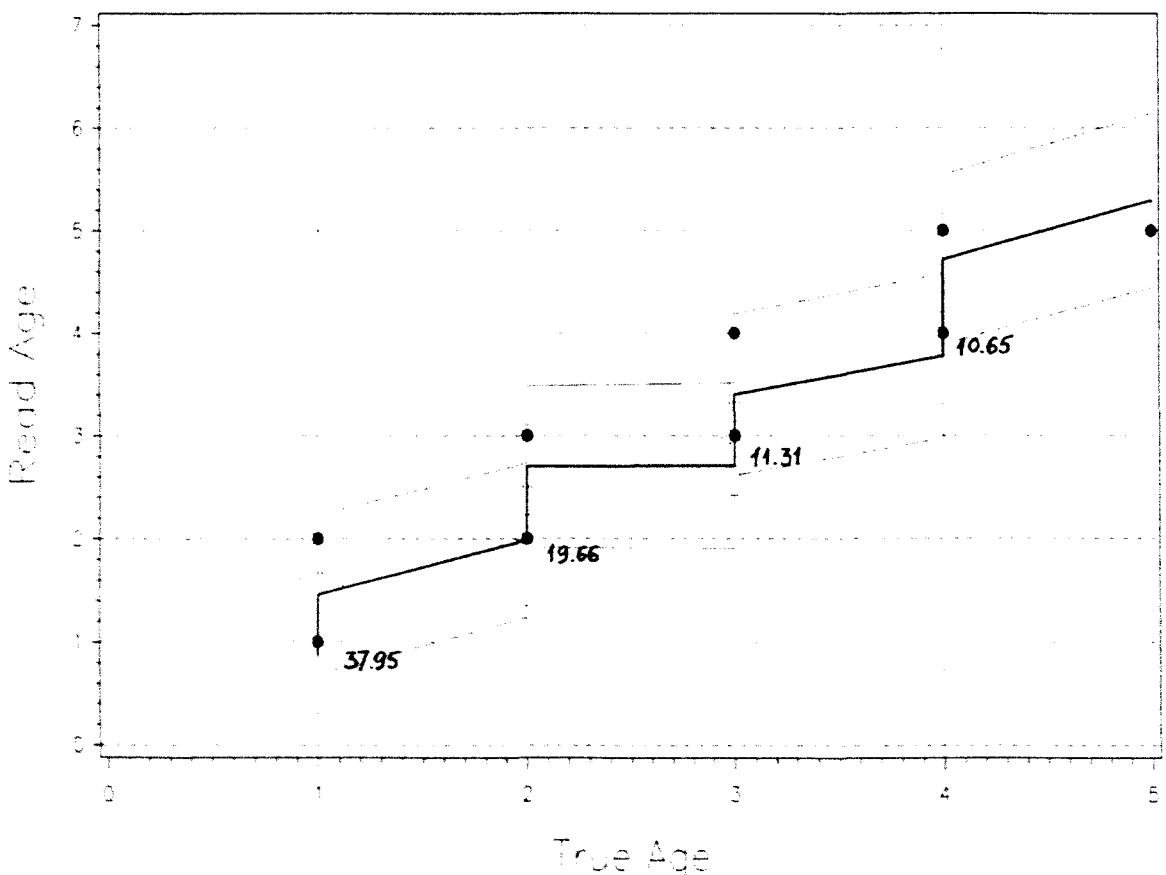
33	16.6378	1	0.5	0.5	1	0	57	43.3846	2
34	0.0000	1	0.5	0.5	1	0	61	54.7500	3

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.07692	2.13442	0.13442	-0.05750	-0.13442	0	0
32	2	2.07692	2.16510	0.16510	-0.08818	-0.16510	0	0
33	2	2.07692	2.25715	0.25715	-0.18022	-0.25715	0	0
34	3	2.87500	3.05868	0.05868	-0.18368	-0.05868	0	0
				-1.00000	-0.00000	-0.00000	-1	3

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	1.81839	-0.18161	0.18161	2	0	0
32	1.77694	-0.22306	0.22306	2	0	0
33	1.65259	-0.34741	0.34741	2	0	0
34	2.92072	-0.07928	0.07928	3	0	0
		-0.00000	7.37893		-1	3

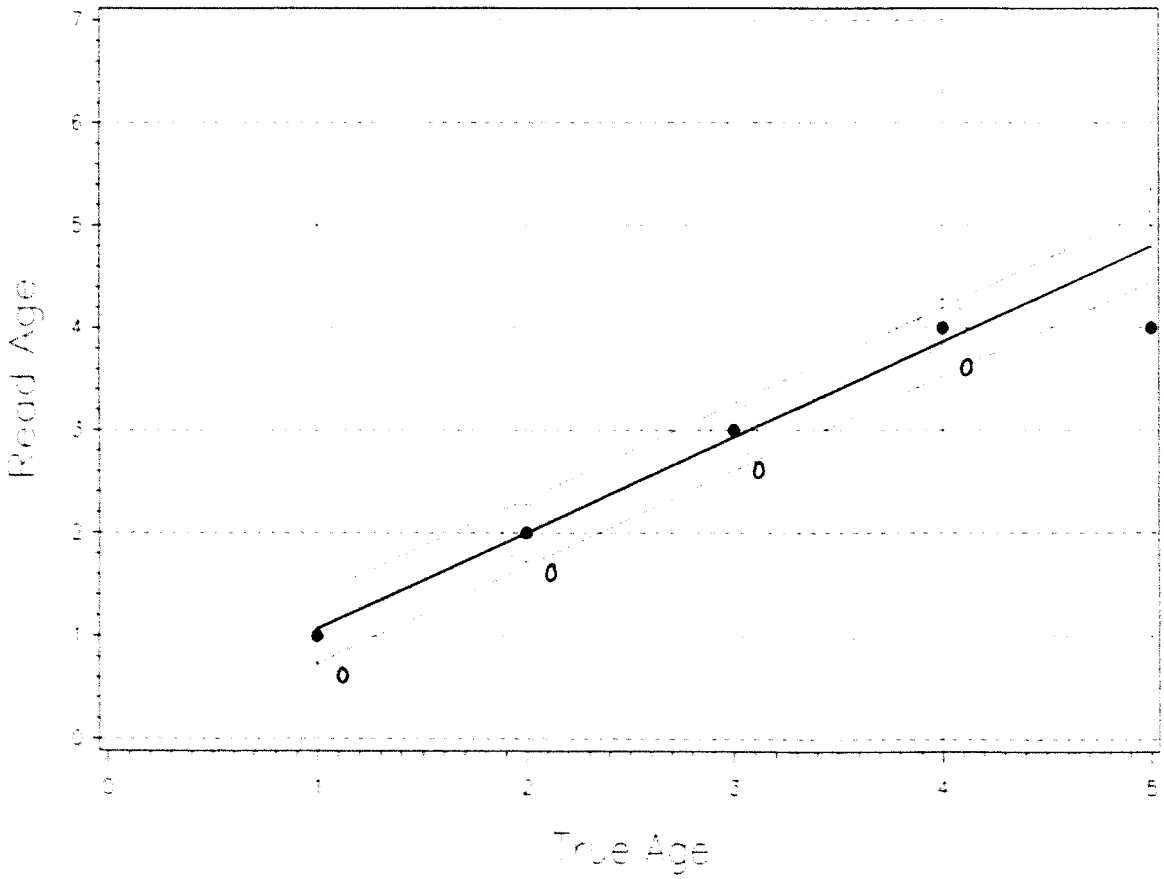
MODEL: read = f (true rda_mean length) /...

(COD22BRA)



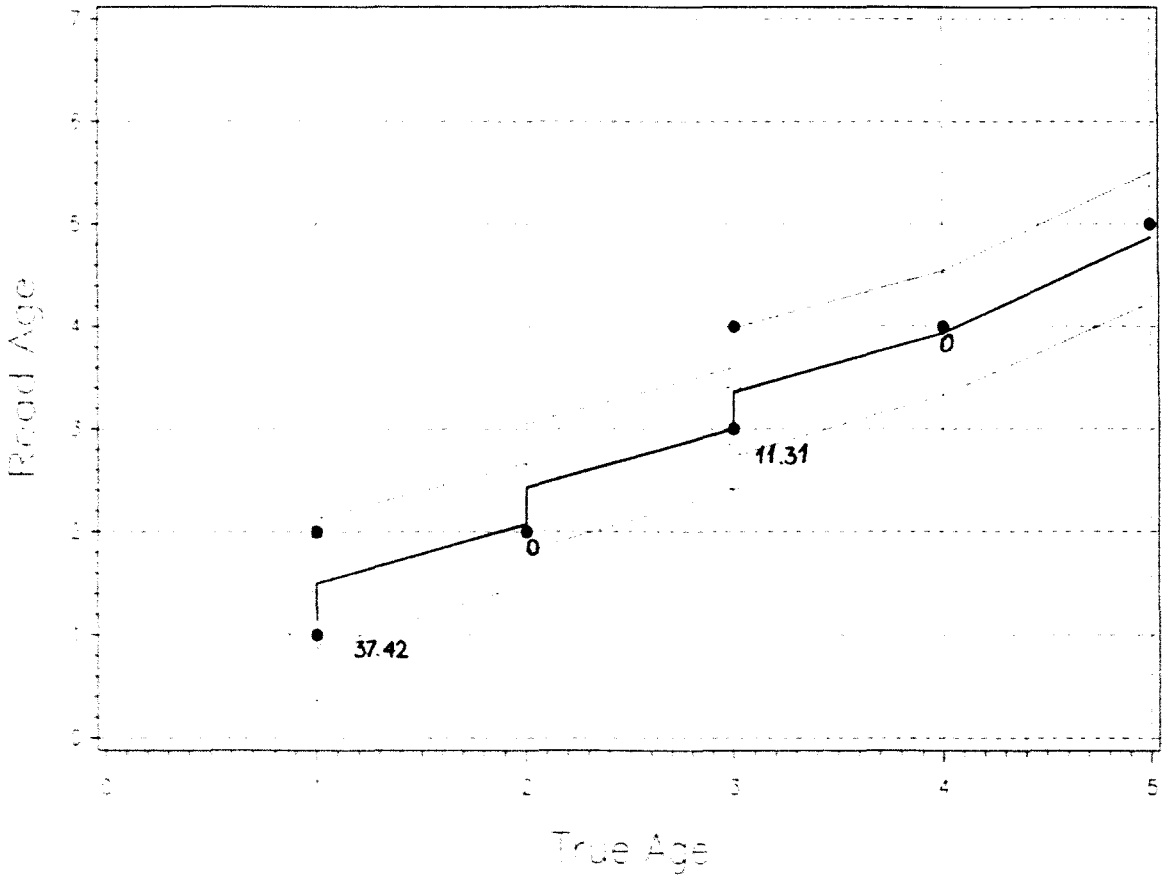
MODEL: read = f (true) /...

(COD22BRO)



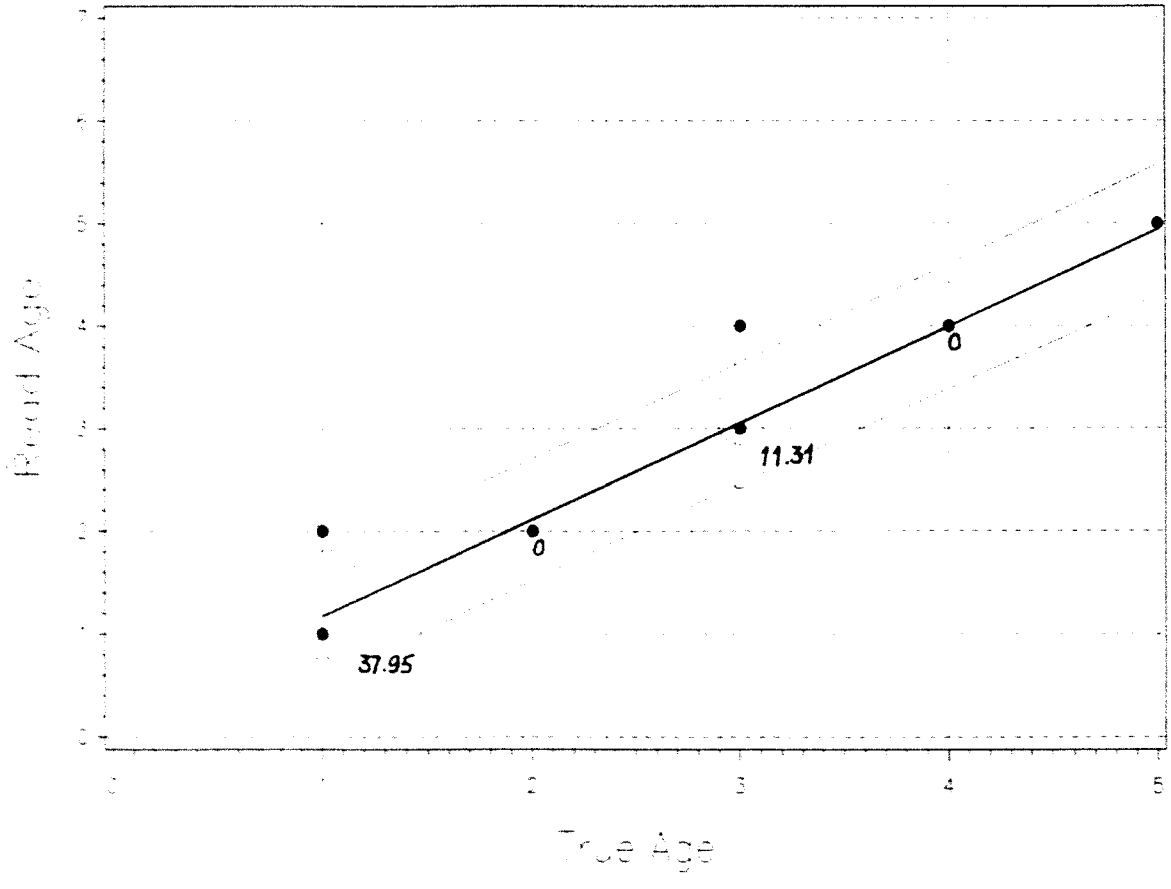
MODEL: read = f (true rda) /...

(COD22H0F)



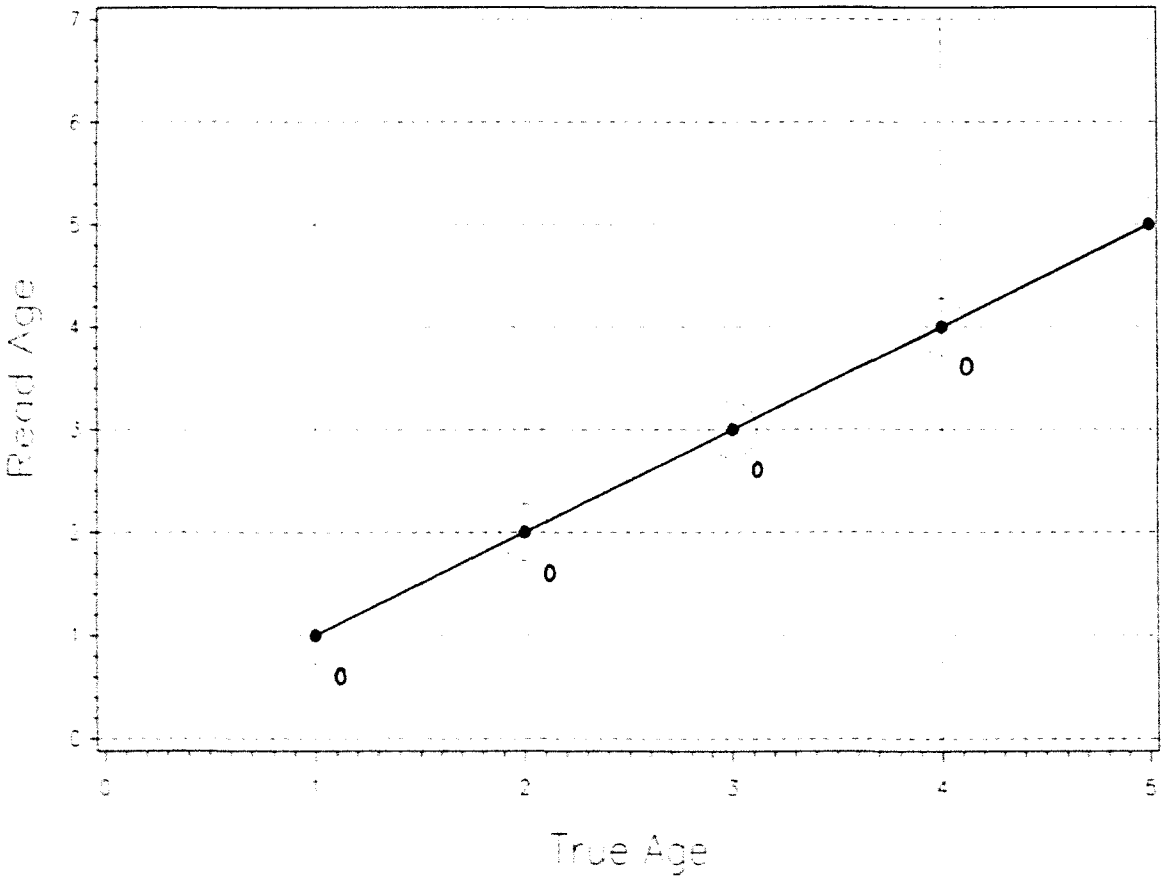
MODEL: read = f (true) /...

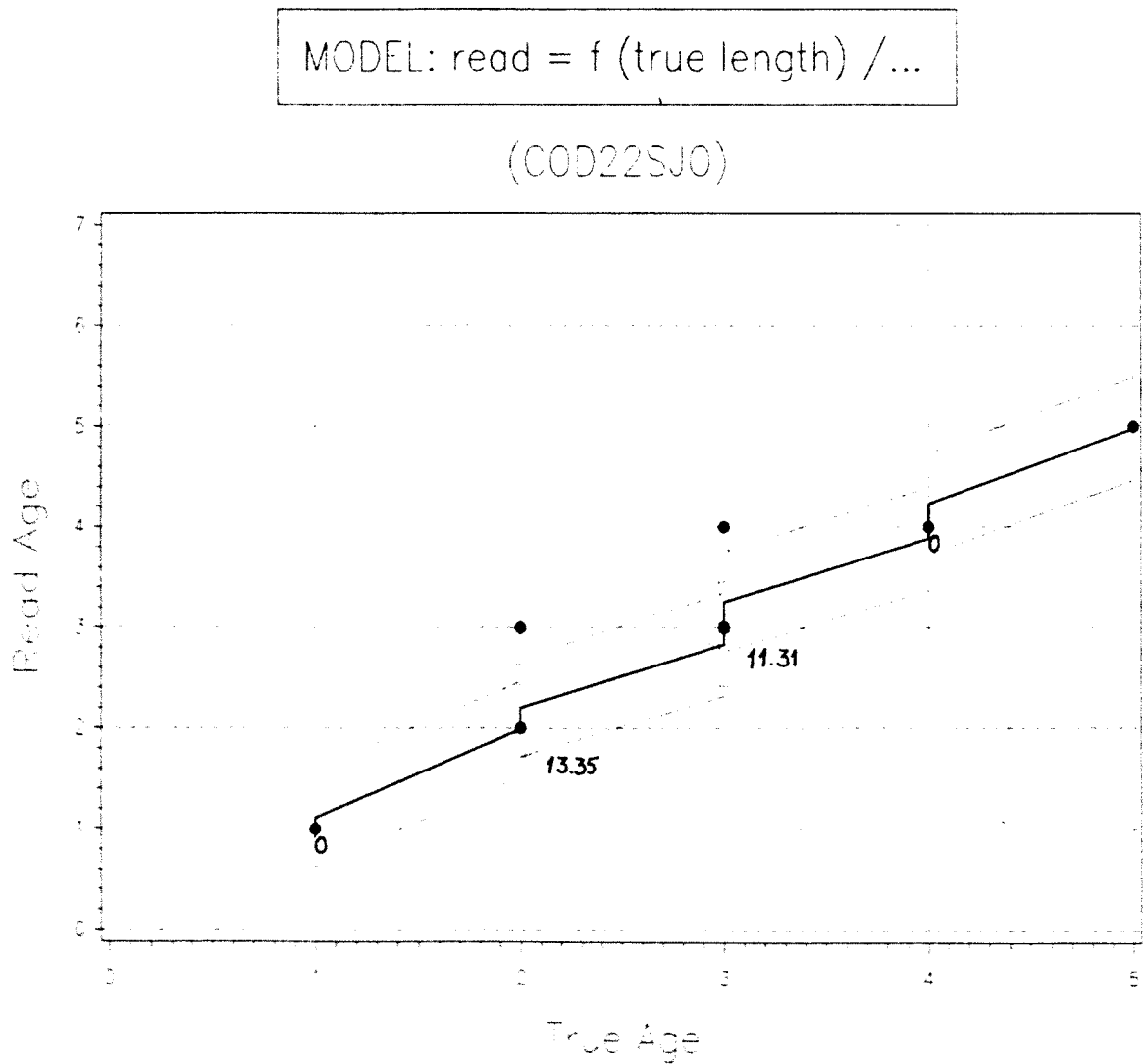
(COD22LUN)



MODEL: read = f (true) /... noint

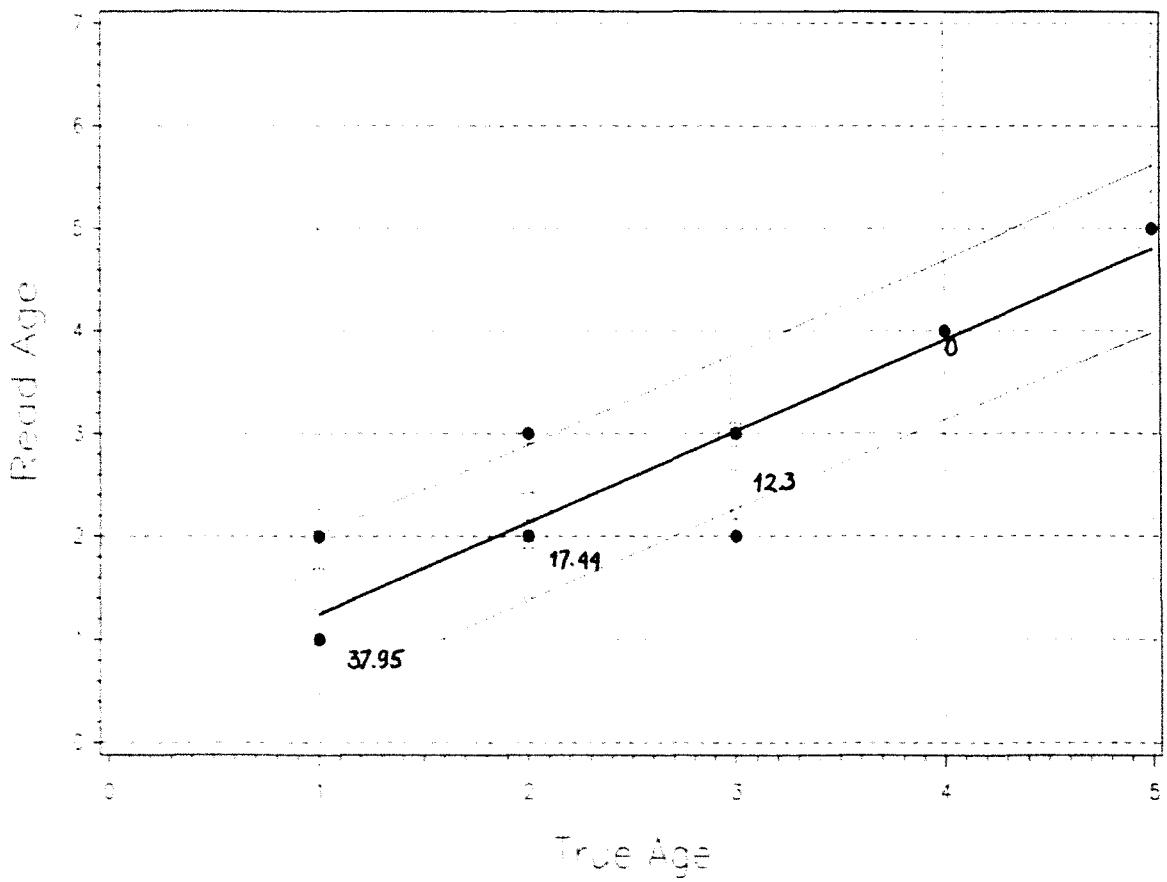
(COD22PCU)




MODEL: read = f (true length) /...
(COD22SJO)
Read Age
True Age
13.35
11.31

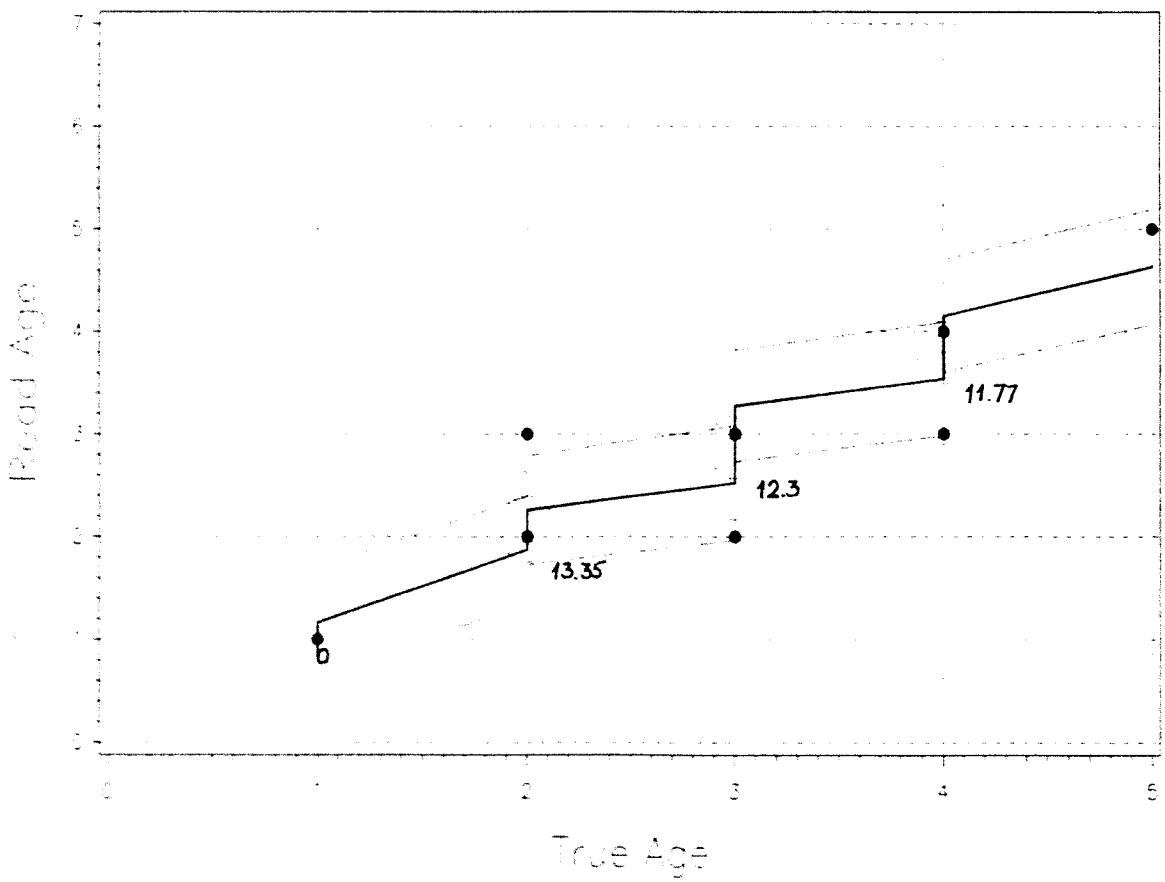
MODEL: read = f (true) /...

(COD22ULR)



MODEL: read = f (true length) /...

(COD22WAL)



.SD 24

A G E R E A D I N G

Date - Time : 08OCT96 - 16:44:34
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD24.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\STAT24_1.OUT

Number data records : 392
Approx. of True Age : Mode
Width of CV category: 10

CVGROUP=1

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
1	10	1	1	1	1.000	1	0.00000
2	10	28	1	1	1.000	1	0.00000
3	10	29	1	1	1.000	1	0.00000
4	10	34	3	3	3.000	3	0.00000
5	10	41	1	1	1.000	1	0.00000
6	10	42	1	1	1.000	1	0.00000
7	10	44	2	2	2.000	2	0.00000
8	10	46	2	2	2.000	2	0.00000
9	10	39	4	4	4.125	4	8.57099
10	10	37	4	4	3.875	4	9.12396

CVGROUP=2

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
11	20	7	3	3.0	3.125	3	11.3137
12	20	9	4	4.0	4.375	4	11.8297
13	20	16	4	4.0	3.750	4	12.3443
14	20	49	4	4.0	3.750	4	12.3443
15	20	36	4	4.0	4.000	4	13.3631
16	20	14	3	3.0	3.250	3	14.2434
17	20	38	3	3.0	3.250	3	14.2434
18	20	6	4	4.0	3.625	4	14.2772
19	20	23	4	4.0	3.625	4	14.2772
20	20	48	4	4.0	3.625	4	14.2772
21	20	12	2	2.0	2.125	2	16.6378
22	20	20	2	2.0	2.125	2	16.6378
23	20	8	5	5.0	4.500	5	16.7984
24	20	10	5	5.5	5.500	6	16.8331
25	20	33	3	3.0	2.750	3	16.8331
26	20	30	2	2.0	1.875	2	18.8562

27	20	35	4	4.0	3.750	4	18.8562
28	20	22	4	4.0	4.000	4	18.8982

CVGROUP=3

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
29	30	4	2	2.0	2.250	2	20.5738
30	30	5	2	2.0	2.250	2	20.5738
31	30	13	2	2.0	2.250	2	20.5738
32	30	15	4	4.0	4.375	4	20.9400
33	30	24	4	4.0	4.375	4	20.9400
34	30	47	2	2.5	2.500	3	21.3809
35	30	21	3	3.0	2.750	3	25.7130
36	30	3	2	2.0	2.000	2	26.7261
37	30	32	2	2.0	2.000	2	26.7261

CVGROUP=4

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
38	40	31	2	2	2.125	2	30.1586
39	40	2	1	1	1.125	1	31.4270
40	40	19	1	1	1.125	1	31.4270

'
'
'

CVGROUP=4 (continued)

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
41	40	27	1	1.0	1.125	1	31.4270
42	40	45	2	2.0	1.625	2	31.8492
43	40	43	1	1.5	1.500	2	35.6348
44	40	11	1	1.0	1.250	1	37.0328
45	40	17	1	1.0	1.250	1	37.0328
46	40	18	1	1.0	1.250	1	37.0328

CVGROUP=7

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
47	70	40	1	1	0.75	1	61.7213

CVGROUP=9

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
48	90	26	1	1	0.625	1	82.8079

CVGROUP=29

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
49	290	25	0	0	0.125	0	282.843

General Linear Models Procedure
Class Level Information

Class	Levels	Values
NATION	4	D DK SKK SLY
TRUE	6	0 1 2 3 4 5

Number of observations in data set = 392

General Linear Models Procedure

Dependent Variable: AGE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	628.66369048	78.58296131	303.37	0.0001
Error	383	99.21130952	0.25903736		
Corrected Total	391	727.87500000			

R-Square	C.V.	Root MSE	AGE Mean
0.863697	20.50475	0.5089571	2.4821429

Source	DF	Type I SS	Mean Square	F Value	Pr > F
NATION	3	7.94642857	2.64880952	10.23	0.0001
TRUE	5	620.71726190	124.14345238	479.25	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
NATION	3	7.94642857	2.64880952	10.23	0.0001
TRUE	5	620.71726190	124.14345238	479.25	0.0001

General Linear Models Procedure

Bonferroni (Dunn) T tests for variable: AGE

NOTE: This test controls the type I experimentwise error rate, but generally has a higher type II error rate than REGWQ.

Alpha= 0.05 df= 383 MSE= 0.259037

Critical Value of T= 2.65
Minimum Significant Difference= 0.1928

Means with the same letter are not significantly different.

Bon Grouping		Mean	N	NATION
	A	2.68367	98	D
	A			
B	A	2.51020	98	SLY
B				
B	C	2.44898	98	SKK
	C			
	C	2.28571	98	DK

A G E R E A D I N G

Date - Time : 28SEP96 - 12:05:12
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD24.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD24BRA.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD24BRA.DP

Reader : 'READER 1 '
Number data records : 49

Dependent Variable : read
Independ. Variable/s: true rda rda_good rectangl (4)
Options (PROC REG) : noint
Size Def. : length > 38

Regression and Tests 2

Model: M1
NOTE: No intercept in model. R-square is redefined.
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	4	407.63802	101.90950	1364.054	0.0001
Error	45	3.36198	0.07471		
U Total	49	411.00000			

Root MSE	0.27333	R-square	0.9918
Dep Mean	2.51020	Adj R-sq	0.9911
C.V.	10.88886		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|

TRUE	1	1.058569	0.03145450	33.654	0.0001
RDA	1	0.978012	0.27772377	3.522	0.0010
RDA_GOOD	1	0.434853	0.14705079	2.957	0.0049
RECTANGL	1	-0.000260	0.00006936	-3.754	0.0005

Regression and Tests 3

Dependent Variable: READ

Test: T_TRUE Numerator: 0.2590 DF: 1 F value: 3.4672
Denominator: 0.074711 DF: 45 Prob>F: 0.0691

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
0	0.00000	0.50000	9.0000	.	1
1	0.92857	0.64286	23.1429	28.7820	14
2	2.07692	0.65385	40.3846	13.3539	13
3	3.00000	0.83333	52.8333	0.0000	6
4	4.15385	0.76923	62.3846	9.0406	13
5	5.50000	1.00000	70.5000	12.8565	2

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.000	1	0.5	0.64286	1	0	10	23.1429	1
2	31.427	1	0.5	0.64286	1	0	21	23.1429	1
3	26.726	2	1.0	0.65385	0	1	33	40.3846	2
4	20.574	1	0.5	0.65385	1	0	38	40.3846	2
5	20.574	1	0.5	0.65385	1	0	44	40.3846	2
6	14.277	2	1.0	0.76923	0	1	52	62.3846	4
7	11.314	1	0.5	0.83333	1	0	58	52.8333	3
8	16.798	2	1.0	1.00000	0	1	64	70.5000	5
9	11.830	2	1.0	0.76923	0	1	73	62.3846	4
10	16.833	2	1.0	1.00000	0	1	77	70.5000	5
11	37.033	1	0.5	0.64286	1	0	18	23.1429	1
12	16.638	1	0.5	0.65385	1	0	28	40.3846	2
13	20.574	1	0.5	0.65385	1	0	34	40.3846	2
14	14.243	2	1.0	0.83333	0	1	49	52.8333	3
15	20.940	1	0.5	0.76923	1	0	68	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	0.92857	0.97791	-0.02209	-0.04934	0.02209	0	0
2	1	0.92857	0.97791	-0.02209	-0.04934	0.02209	0	0

3	2	2.07692	2.09063	0.09063	-0.01371	-0.09063	0	0
4	2	2.07692	2.03648	0.03648	0.04044	-0.03648	0	0
5	2	2.07692	2.03648	0.03648	0.04044	-0.03648	0	0
6	4	4.15385	4.20777	0.20777	-0.05393	-0.20777	0	0
7	3	3.00000	3.09479	0.09479	-0.09479	-0.09479	0	0
8	5	5.50000	5.24030	0.24030	0.25970	-0.24030	0	0
9	5	4.15385	4.18173	0.18173	-0.02789	0.81827	1	1
10	6	5.50000	5.24030	0.24030	0.25970	0.75970	1	1
11	1	0.92857	0.95187	-0.04813	-0.02330	0.04813	0	0
12	2	2.07692	2.01044	0.01044	0.06648	-0.01044	0	0
13	2	2.07692	2.01044	0.01044	0.06648	-0.01044	0	0
14	3	3.00000	3.12317	0.12317	-0.12317	-0.12317	0	0
15	4	4.15385	4.12758	0.12758	0.02626	-0.12758	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	1.02087	0.02087	0.02087	1	0	0
2	1.02087	0.02087	0.02087	1	0	0
3	1.91438	-0.08562	0.08562	2	0	0
4	1.96554	-0.03446	0.03446	2	0	0
5	1.96554	-0.03446	0.03446	2	0	0
6	3.80372	-0.19628	0.19628	4	0	0
7	2.91045	-0.08955	0.08955	3	0	0
8	4.77299	-0.22701	0.22701	5	0	0
9	4.77299	0.77299	0.77299	5	1	1
10	5.71766	0.71766	0.71766	6	1	1
11	1.04546	0.04546	0.04546	1	0	0
12	1.99013	-0.00987	0.00987	2	0	0
13	1.99013	-0.00987	0.00987	2	0	0
14	2.88365	-0.11635	0.11635	3	0	0
15	3.87948	-0.12052	0.12052	4	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	12.344	1	0.5	0.76923	1	0	80	62.3846	4
17	37.033	2	1.0	0.64286	0	1	19	23.1429	1
18	37.033	2	1.0	0.64286	0	1	22	23.1429	1
19	31.427	2	1.0	0.64286	0	1	28	23.1429	1
20	16.638	2	1.0	0.65385	0	1	33	40.3846	2
21	25.713	2	1.0	0.83333	0	1	39	52.8333	3
22	18.898	2	1.0	0.76923	0	1	44	62.3846	4
23	14.277	2	1.0	0.76923	0	1	49	62.3846	4
24	20.940	2	1.0	0.76923	0	1	52	62.3846	4
25	282.843	1	0.5	0.50000	1	0	9	9.0000	0
26	82.808	.	0.0	0.64286	0	0	13	23.1429	1
27	31.427	1	0.5	0.64286	1	0	18	23.1429	1
28	0.000	1	0.5	0.64286	1	0	24	23.1429	1
29	0.000	1	0.5	0.64286	1	0	28	23.1429	1
30	18.856	2	1.0	0.65385	0	1	34	40.3846	2

Otol.	Read	Mean Read	Estim. Model	Model Age -	Mean Read Age -	Read Age -	|Read Age -

No.	Age	Age	Age	True Age	Model Age	Residuals	True Age	True Age|
16	4	4.15385	4.12758	0.12758	0.02626	-0.12758	0	0
17	1	0.92857	1.03206	0.03206	-0.10349	-0.03206	0	0
18	1	0.92857	1.03180	0.03180	-0.10323	-0.03180	0	0
19	1	0.92857	1.03180	0.03180	-0.10323	-0.03180	0	0
20	2	2.07692	2.09037	0.09037	-0.01345	-0.09037	0	0
21	3	3.00000	3.14894	0.14894	-0.14894	-0.14894	0	0
22	5	4.15385	4.20751	0.20751	-0.05367	0.79249	1	1
23	4	4.15385	4.20751	0.20751	-0.05367	-0.20751	0	0
24	4	4.15385	4.20751	0.20751	-0.05367	-0.20751	0	0
25	0	0.00000	-0.10669	-0.10669	0.10669	0.10669	0	0
26	0	0.92857	0.02802	-0.97198	0.90056	-0.02802	-1	1
27	1	0.92857	0.95187	-0.04813	-0.02330	0.04813	0	0
28	1	0.92857	0.95187	-0.04813	-0.02330	0.04813	0	0
29	1	0.92857	0.95187	-0.04813	-0.02330	0.04813	0	0
30	2	2.07692	2.09063	0.09063	-0.01371	-0.09063	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	3.87948	-0.12052	0.12052	4	0	0
17	0.96971	-0.03029	0.03029	1	0	0
18	0.96996	-0.03004	0.03004	1	0	0
19	0.96996	-0.03004	0.03004	1	0	0
20	1.91463	-0.08537	0.08537	2	0	0
21	2.85930	-0.14070	0.14070	3	0	0
22	4.74864	0.74864	0.74864	5	1	1
23	3.80397	-0.19603	0.19603	4	0	0
24	3.80397	-0.19603	0.19603	4	0	0
25	0.10079	0.10079	0.10079	0	0	0
26	0.97354	-0.02646	0.02646	1	0	0
27	1.04546	0.04546	0.04546	1	0	0
28	1.04546	0.04546	0.04546	1	0	0
29	1.04546	0.04546	0.04546	1	0	0
30	1.91438	-0.08562	0.08562	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	30.159	2	1.0	0.65385	0	1	35	40.3846	2
32	26.726	1	0.5	0.65385	1	0	41	40.3846	2
33	16.833	1	0.5	0.83333	1	0	47	52.8333	3
34	0.000	2	1.0	0.83333	0	1	54	52.8333	3
35	18.856	2	1.0	0.76923	0	1	58	62.3846	4
36	13.363	1	0.5	0.76923	1	0	60	62.3846	4
37	9.124	1	0.5	0.76923	1	0	68	62.3846	4
38	14.243	2	1.0	0.83333	0	1	70	52.8333	3
39	8.571	2	1.0	0.76923	0	1	78	62.3846	4
40	61.721	2	1.0	0.64286	0	1	23	23.1429	1
41	0.000	1	0.5	0.64286	1	0	28	23.1429	1
42	0.000	1	0.5	0.64286	1	0	34	23.1429	1
43	35.635	2	1.0	0.64286	0	1	38	23.1429	1
44	0.000	1	0.5	0.65385	1	0	44	40.3846	2
45	31.849	1	0.5	0.65385	1	0	49	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.07692	2.09037	0.09037	-0.01345	-0.09037	0	0
32	2	2.07692	2.03622	0.03622	0.04070	-0.03622	0	0
33	3	3.00000	3.09479	0.09479	-0.09479	-0.09479	0	0
34	3	3.00000	3.14894	0.14894	-0.14894	-0.14894	0	0
35	4	4.15385	4.20777	0.20777	-0.05393	-0.20777	0	0
36	4	4.15385	4.15336	0.15336	0.00049	-0.15336	0	0
37	4	4.15385	4.15362	0.15362	0.00023	-0.15362	0	0
38	3	3.00000	3.14894	0.14894	-0.14894	-0.14894	0	0
39	4	4.15385	4.20777	0.20777	-0.05393	-0.20777	0	0
40	1	0.92857	1.03206	0.03206	-0.10349	-0.03206	0	0
41	1	0.92857	1.00421	0.00421	-0.07564	-0.00421	0	0
42	1	0.92857	1.00421	0.00421	-0.07564	-0.00421	0	0
43	1	0.92857	1.03206	0.03206	-0.10349	-0.03206	0	0
44	2	2.07692	2.06278	0.06278	0.01414	-0.06278	0	0
45	2	2.07692	2.03648	0.03648	0.04044	-0.03648	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	1.91463	-0.08537	0.08537	2	0	0
32	1.96578	-0.03422	0.03422	2	0	0
33	2.91045	-0.08955	0.08955	3	0	0
34	2.85930	-0.14070	0.14070	3	0	0
35	3.80372	-0.19628	0.19628	4	0	0
36	3.85513	-0.14487	0.14487	4	0	0
37	3.85488	-0.14512	0.14512	4	0	0
38	2.85930	-0.14070	0.14070	3	0	0
39	3.80372	-0.19628	0.19628	4	0	0
40	0.96971	-0.03029	0.03029	1	0	0
41	0.99602	-0.00398	0.00398	1	0	0
42	0.99602	-0.00398	0.00398	1	0	0
43	0.96971	-0.03029	0.03029	1	0	0
44	1.94069	-0.05931	0.05931	2	0	0
45	1.96554	-0.03446	0.03446	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
46	0.000	1	0.5	0.65385	1	0	53	40.3846	2
47	21.381	1	0.5	0.65385	1	0	59	40.3846	2
48	14.277	1	0.5	0.76923	1	0	62	62.3846	4
49	12.344	1	0.5	0.76923	1	0	67	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|

46	2	2.07692	2.06278	0.06278	0.01414	-0.06278	0	0
47	3	2.07692	2.03648	0.03648	0.04044	0.96352	1	1
48	4	4.15385	4.12732	0.12732	0.02652	-0.12732	0	0
49	4	4.15385	4.12732	0.12732	0.02652	-0.12732	0	0
				3.02802	-0.02802	-0.02802	3	5

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
46	1.94069	-0.05931	0.05931	2	0	0
47	2.91021	0.91021	0.91021	3	1	1
48	3.87972	-0.12028	0.12028	4	0	0
49	3.87972	-0.12028	0.12028	4	0	0
		-0.02646	6.97422		4	4

A G E R E A D I N G

Date - Time : 28SEP96 - 12:05:32
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD24.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD24BRO.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD24BRO.DP

Reader : 'READER 2 '
Number data records : 49

Dependent Variable : read
Independ. Variable/s: true (1)
Options (PROC REG) :
Size Def. : length > 38

Regression and Tests 2

Model: M1
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	47.12011	47.12011	269.198	0.0001
Error	47	8.22683	0.17504		
C Total	48	55.34694			

Root MSE	0.41838	R-square	0.8514
Dep Mean	2.18367	Adj R-sq	0.8482
C.V.	19.15930		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.350801	0.12669494	2.769	0.0080
TRUE	1	0.748423	0.04561539	16.407	0.0001

Regression and Tests 3

Dependent Variable: READ

Test: T_TRUE Numerator: 5.3242 DF: 1 F value: 30.4172
Denominator: 0.175039 DF: 47 Prob>F: 0.0001

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
0	1.00000	0	9.0000	.	1
1	1.00000	0	23.1429	0.0000	14
2	1.84615	0	40.3846	20.3414	13
3	2.66667	0	52.8333	19.3649	6
4	3.46154	0	62.3846	14.9897	13
5	3.50000	0	70.5000	20.2031	2

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.000	.	0	0	0	0	10	23.1429	1
2	31.427	.	0	0	0	0	21	23.1429	1
3	26.726	.	0	0	0	0	33	40.3846	2
4	20.574	.	0	0	0	0	38	40.3846	2
5	20.574	.	0	0	0	0	44	40.3846	2
6	14.277	.	0	0	0	0	52	62.3846	4
7	11.314	.	0	0	0	0	58	52.8333	3
8	16.798	.	0	0	0	0	64	70.5000	5
9	11.830	.	0	0	0	0	73	62.3846	4
10	16.833	.	0	0	0	0	77	70.5000	5
11	37.033	.	0	0	0	0	18	23.1429	1
12	16.638	.	0	0	0	0	28	40.3846	2
13	20.574	.	0	0	0	0	34	40.3846	2
14	14.243	.	0	0	0	0	49	52.8333	3
15	20.940	.	0	0	0	0	68	62.3846	4

Otol.	Read	Mean Read	Estim. Model	Age -	Mean Read Age -	Read Age -	|Read Age -

No.	Age	Age	Age	True Age	Model Age	Residuals	True Age	True Age|
1	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
2	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
3	1	1.84615	1.84765	-0.1524	-0.00149	-0.84765	-1	1
4	2	1.84615	1.84765	-0.1524	-0.00149	0.15235	0	0
5	2	1.84615	1.84765	-0.1524	-0.00149	0.15235	0	0
6	4	3.46154	3.34449	-0.6555	0.11705	0.65551	0	0
7	3	2.66667	2.59607	-0.4039	0.07060	0.40393	0	0
8	3	3.50000	4.09292	-0.9071	-0.59292	-1.09292	-2	2
9	4	3.46154	3.34449	-0.6555	0.11705	0.65551	0	0
10	4	3.50000	4.09292	-0.9071	-0.59292	-0.09292	-1	1
11	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
12	2	1.84615	1.84765	-0.1524	-0.00149	0.15235	0	0
13	2	1.84615	1.84765	-0.1524	-0.00149	0.15235	0	0
14	3	2.66667	2.59607	-0.4039	0.07060	0.40393	0	0
15	3	3.46154	3.34449	-0.6555	0.11705	-0.34449	-1	1

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	0.86742	-0.13258	0.1326	1	0	0
2	0.86742	-0.13258	0.1326	1	0	0
3	0.86742	-1.13258	1.1326	1	-1	1
4	2.20357	0.20357	0.2036	2	0	0
5	2.20357	0.20357	0.2036	2	0	0
6	4.87585	0.87585	0.8759	5	1	1
7	3.53971	0.53971	0.5397	4	1	1
8	3.53971	-1.46029	1.4603	4	-1	1
9	4.87585	0.87585	0.8759	5	1	1
10	4.87585	-0.12415	0.1241	5	0	0
11	0.86742	-0.13258	0.1326	1	0	0
12	2.20357	0.20357	0.2036	2	0	0
13	2.20357	0.20357	0.2036	2	0	0
14	3.53971	0.53971	0.5397	4	1	1
15	3.53971	-0.46029	0.4603	4	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	12.344	.	0	0	0	0	80	62.3846	4
17	37.033	.	0	0	0	0	19	23.1429	1
18	37.033	.	0	0	0	0	22	23.1429	1
19	31.427	.	0	0	0	0	28	23.1429	1
20	16.638	.	0	0	0	0	33	40.3846	2
21	25.713	.	0	0	0	0	39	52.8333	3
22	18.898	.	0	0	0	0	44	62.3846	4
23	14.277	.	0	0	0	0	49	62.3846	4
24	20.940	.	0	0	0	0	52	62.3846	4
25	282.843	.	0	0	0	0	9	9.0000	0
26	82.808	.	0	0	0	0	13	23.1429	1
27	31.427	.	0	0	0	0	18	23.1429	1
28	0.000	.	0	0	0	0	24	23.1429	1
29	0.000	.	0	0	0	0	28	23.1429	1
30	18.856	.	0	0	0	0	34	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	3	3.46154	3.34449	-0.6555	0.11705	-0.34449	-1	1
17	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
18	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
19	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
20	2	1.84615	1.84765	-0.1524	-0.00149	0.15235	0	0
21	2	2.66667	2.59607	-0.4039	0.07060	-0.59607	-1	1
22	3	3.46154	3.34449	-0.6555	0.11705	-0.34449	-1	1
23	3	3.46154	3.34449	-0.6555	0.11705	-0.34449	-1	1
24	4	3.46154	3.34449	-0.6555	0.11705	0.65551	0	0
25	1	1.00000	0.35080	0.3508	0.64920	0.64920	1	1
26	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
27	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
28	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
29	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
30	2	1.84615	1.84765	-0.1524	-0.00149	0.15235	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	3.53971	-0.46029	0.4603	4	0	0
17	0.86742	-0.13258	0.1326	1	0	0
18	0.86742	-0.13258	0.1326	1	0	0
19	0.86742	-0.13258	0.1326	1	0	0
20	2.20357	0.20357	0.2036	2	0	0
21	2.20357	-0.79643	0.7964	2	-1	1
22	3.53971	-0.46029	0.4603	4	0	0
23	3.53971	-0.46029	0.4603	4	0	0
24	4.87585	0.87585	0.8759	5	1	1
25	0.86742	0.86742	0.8674	1	1	1
26	0.86742	-0.13258	0.1326	1	0	0
27	0.86742	-0.13258	0.1326	1	0	0
28	0.86742	-0.13258	0.1326	1	0	0
29	0.86742	-0.13258	0.1326	1	0	0
30	2.20357	0.20357	0.2036	2	0	0

Estim. of means, biases and dispersion 7

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Average Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	30.159	.	0	0	0	0	35	40.3846	2
32	26.726	.	0	0	0	0	41	40.3846	2
33	16.833	.	0	0	0	0	47	52.8333	3
34	0.000	.	0	0	0	0	54	52.8333	3
35	18.856	.	0	0	0	0	58	62.3846	4
36	13.363	.	0	0	0	0	60	62.3846	4
37	9.124	.	0	0	0	0	68	62.3846	4
38	14.243	.	0	0	0	0	70	52.8333	3
39	8.571	.	0	0	0	0	78	62.3846	4
40	61.721	.	0	0	0	0	23	23.1429	1
41	0.000	.	0	0	0	0	28	23.1429	1

42	0.000	.	0	0	0	0	34	23.1429	1
43	35.635	.	0	0	0	0	38	23.1429	1
44	0.000	.	0	0	0	0	44	40.3846	2
45	31.849	.	0	0	0	0	49	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	1.84615	1.84765	-0.1524	-0.00149	0.15235	0	0
32	1	1.84615	1.84765	-0.1524	-0.00149	-0.84765	-1	1
33	2	2.66667	2.59607	-0.4039	0.07060	-0.59607	-1	1
34	3	2.66667	2.59607	-0.4039	0.07060	0.40393	0	0
35	3	3.46154	3.34449	-0.6555	0.11705	-0.34449	-1	1
36	3	3.46154	3.34449	-0.6555	0.11705	-0.34449	-1	1
37	3	3.46154	3.34449	-0.6555	0.11705	-0.34449	-1	1
38	3	2.66667	2.59607	-0.4039	0.07060	0.40393	0	0
39	4	3.46154	3.34449	-0.6555	0.11705	0.65551	0	0
40	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
41	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
42	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
43	1	1.00000	1.09922	0.0992	-0.09922	-0.09922	0	0
44	2	1.84615	1.84765	-0.1524	-0.00149	0.15235	0	0
45	2	1.84615	1.84765	-0.1524	-0.00149	0.15235	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	2.20357	0.20357	0.2036	2	0	0
32	0.86742	-1.13258	1.1326	1	-1	1
33	2.20357	-0.79643	0.7964	2	-1	1
34	3.53971	0.53971	0.5397	4	1	1
35	3.53971	-0.46029	0.4603	4	0	0
36	3.53971	-0.46029	0.4603	4	0	0
37	3.53971	-0.46029	0.4603	4	0	0
38	3.53971	0.53971	0.5397	4	1	1
39	4.87585	0.87585	0.8759	5	1	1
40	0.86742	-0.13258	0.1326	1	0	0
41	0.86742	-0.13258	0.1326	1	0	0
42	0.86742	-0.13258	0.1326	1	0	0
43	0.86742	-0.13258	0.1326	1	0	0
44	2.20357	0.20357	0.2036	2	0	0
45	2.20357	0.20357	0.2036	2	0	0

Estim. of means, biases and dispersion 8

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
46	0.000	.	0	0	0	0	53	40.3846	2
47	21.381	.	0	0	0	0	59	40.3846	2
48	14.277	.	0	0	0	0	62	62.3846	4
49	12.344	.	0	0	0	0	67	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
46	2	1.84615	1.84765	-0.1524	-0.00149	0.15235	0	0
47	2	1.84615	1.84765	-0.1524	-0.00149	0.15235	0	0
48	4	3.46154	3.34449	-0.6555	0.11705	0.65551	0	0
49	4	3.46154	3.34449	-0.6555	0.11705	0.65551	0	0
				-13.0000	0.00000	-0.00000	-13	15

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
46	2.20357	0.20357	0.2036	2	0	0
47	2.20357	0.20357	0.2036	2	0	0
48	4.87585	0.87585	0.8759	5	1	1
49	4.87585	0.87585	0.8759	5	1	1
		0.00000	21.0412		6	16

A G E R E A D I N G

Date - Time : 28SEP96 - 12:05:51
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD24.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD24HOF.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD24HOF.DP

Reader : 'READER 3'
Number data records : 49

Dependent Variable : read
Independ. Variable/s: true (1)
Options (PROC REG) :
Size Def. : length > 38

Regression and Tests 2

Model: M1
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	74.61171	74.61171	198.872	0.0001
Error	47	17.63319	0.37517		
C Total	48	92.24490			

Root MSE	0.61251	R-square	0.8088
Dep Mean	2.48980	Adj R-sq	0.8048
C.V.	24.60100		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.183406	0.18548483	0.989	0.3278
TRUE	1	0.941776	0.06678217	14.102	0.0001

Regression and Tests 3

Dependent Variable: READ

Test: T_TRUE Numerator: 0.2852 DF: 1 F value: 0.7601
Denominator: 0.375174 DF: 47 Prob>F: 0.3877

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
0	0.00000	1.00000	9.0000	.	1
1	1.21429	0.67857	23.1429	47.6769	14
2	2.00000	0.65385	40.3846	20.4124	13
3	2.83333	0.58333	52.8333	26.5684	6
4	4.00000	0.61538	62.3846	17.6777	13
5	5.00000	0.50000	70.5000	28.2843	2

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.000	2	1.0	0.67857	0	1	10	23.1429	1
2	31.427	2	1.0	0.67857	0	1	21	23.1429	1
3	26.726	2	1.0	0.65385	0	1	33	40.3846	2
4	20.574	1	0.5	0.65385	1	0	38	40.3846	2
5	20.574	1	0.5	0.65385	1	0	44	40.3846	2
6	14.277	1	0.5	0.61538	1	0	52	62.3846	4
7	11.314	1	0.5	0.58333	1	0	58	52.8333	3
8	16.798	1	0.5	0.50000	1	0	64	70.5000	5
9	11.830	2	1.0	0.61538	0	1	73	62.3846	4
10	16.833	1	0.5	0.50000	1	0	77	70.5000	5
11	37.033	2	1.0	0.67857	0	1	18	23.1429	1
12	16.638	1	0.5	0.65385	1	0	28	40.3846	2
13	20.574	2	1.0	0.65385	0	1	34	40.3846	2
14	14.243	1	0.5	0.58333	1	0	49	52.8333	3
15	20.940	1	0.5	0.61538	1	0	68	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.21429	1.12518	0.12518	0.08910	-0.12518	0	0
2	1	1.21429	1.12518	0.12518	0.08910	-0.12518	0	0
3	2	2.00000	2.06696	0.06696	-0.06696	-0.06696	0	0
4	2	2.00000	2.06696	0.06696	-0.06696	-0.06696	0	0
5	2	2.00000	2.06696	0.06696	-0.06696	-0.06696	0	0
6	3	4.00000	3.95051	-0.04949	0.04949	-0.95051	-1	1
7	3	2.83333	3.00873	0.00873	-0.17540	-0.00873	0	0
8	4	5.00000	4.89229	-0.10771	0.10771	-0.89229	-1	1
9	5	4.00000	3.95051	-0.04949	0.04949	1.04949	1	1
10	6	5.00000	4.89229	-0.10771	0.10771	1.10771	1	1
11	1	1.21429	1.12518	0.12518	0.08910	-0.12518	0	0
12	2	2.00000	2.06696	0.06696	-0.06696	-0.06696	0	0
13	2	2.00000	2.06696	0.06696	-0.06696	-0.06696	0	0
14	4	2.83333	3.00873	0.00873	-0.17540	0.99127	1	1
15	5	4.00000	3.95051	-0.04949	0.04949	1.04949	1	1

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	0.86708	-0.13292	0.1329	1	0	0
2	0.86708	-0.13292	0.1329	1	0	0
3	1.92890	-0.07110	0.0711	2	0	0
4	1.92890	-0.07110	0.0711	2	0	0
5	1.92890	-0.07110	0.0711	2	0	0
6	2.99073	-1.00927	1.0093	3	-1	1
7	2.99073	-0.00927	0.0093	3	0	0
8	4.05255	-0.94745	0.9474	4	-1	1
9	5.11437	1.11437	1.1144	5	1	1
10	6.17620	1.17620	1.1762	6	1	1
11	0.86708	-0.13292	0.1329	1	0	0
12	1.92890	-0.07110	0.0711	2	0	0
13	1.92890	-0.07110	0.0711	2	0	0
14	4.05255	1.05255	1.0526	4	1	1
15	5.11437	1.11437	1.1144	5	1	1

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	12.344	1	0.5	0.61538	1	0	80	62.3846	4
17	37.033	1	0.5	0.67857	1	0	19	23.1429	1
18	37.033	1	0.5	0.67857	1	0	22	23.1429	1
19	31.427	1	0.5	0.67857	1	0	28	23.1429	1
20	16.638	1	0.5	0.65385	1	0	33	40.3846	2
21	25.713	2	1.0	0.58333	0	1	39	52.8333	3
22	18.898	1	0.5	0.61538	1	0	44	62.3846	4
23	14.277	1	0.5	0.61538	1	0	49	62.3846	4
24	20.940	1	0.5	0.61538	1	0	52	62.3846	4
25	282.843	2	1.0	1.00000	0	1	9	9.0000	0
26	82.808	2	1.0	0.67857	0	1	13	23.1429	1

27	31.427	1	0.5	0.67857	1	0	18	23.1429	1
28	0.000	2	1.0	0.67857	0	1	24	23.1429	1
29	0.000	1	0.5	0.67857	1	0	28	23.1429	1
30	18.856	1	0.5	0.65385	1	0	34	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	4	4.00000	3.95051	-0.04949	0.04949	0.04949	0	0
17	2	1.21429	1.12518	0.12518	0.08910	0.87482	1	1
18	2	1.21429	1.12518	0.12518	0.08910	0.87482	1	1
19	1	1.21429	1.12518	0.12518	0.08910	-0.12518	0	0
20	2	2.00000	2.06696	0.06696	-0.06696	-0.06696	0	0
21	2	2.83333	3.00873	0.00873	-0.17540	-1.00873	-1	1
22	4	4.00000	3.95051	-0.04949	0.04949	0.04949	0	0
23	3	4.00000	3.95051	-0.04949	0.04949	-0.95051	-1	1
24	5	4.00000	3.95051	-0.04949	0.04949	1.04949	1	1
25	0	0.00000	0.18341	0.18341	-0.18341	-0.18341	0	0
26	1	1.21429	1.12518	0.12518	0.08910	-0.12518	0	0
27	2	1.21429	1.12518	0.12518	0.08910	0.87482	1	1
28	1	1.21429	1.12518	0.12518	0.08910	-0.12518	0	0
29	1	1.21429	1.12518	0.12518	0.08910	-0.12518	0	0
30	2	2.00000	2.06696	0.06696	-0.06696	-0.06696	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	4.05255	0.05255	0.0526	4	0	0
17	1.92890	0.92890	0.9289	2	1	1
18	1.92890	0.92890	0.9289	2	1	1
19	0.86708	-0.13292	0.1329	1	0	0
20	1.92890	-0.07110	0.0711	2	0	0
21	1.92890	-1.07110	1.0711	2	-1	1
22	4.05255	0.05255	0.0526	4	0	0
23	2.99073	-1.00927	1.0093	3	-1	1
24	5.11437	1.11437	1.1144	5	1	1
25	-0.19474	-0.19474	0.1947	0	0	0
26	0.86708	-0.13292	0.1329	1	0	0
27	1.92890	0.92890	0.9289	2	1	1
28	0.86708	-0.13292	0.1329	1	0	0
29	0.86708	-0.13292	0.1329	1	0	0
30	1.92890	-0.07110	0.0711	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	30.159	1	0.5	0.65385	1	0	35	40.3846	2
32	26.726	2	1.0	0.65385	0	1	41	40.3846	2
33	16.833	1	0.5	0.58333	1	0	47	52.8333	3
34	0.000	1	0.5	0.58333	1	0	54	52.8333	3
35	18.856	1	0.5	0.61538	1	0	58	62.3846	4
36	13.363	1	0.5	0.61538	1	0	60	62.3846	4
37	9.124	1	0.5	0.61538	1	0	68	62.3846	4

38	14.243	1	0.5	0.58333	1	0	70	52.8333	3
39	8.571	1	0.5	0.61538	1	0	78	62.3846	4
40	61.721	1	0.5	0.67857	1	0	23	23.1429	1
41	0.000	1	0.5	0.67857	1	0	28	23.1429	1
42	0.000	1	0.5	0.67857	1	0	34	23.1429	1
43	35.635	1	0.5	0.67857	1	0	38	23.1429	1
44	0.000	1	0.5	0.65385	1	0	44	40.3846	2
45	31.849	1	0.5	0.65385	1	0	49	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	3	2.00000	2.06696	0.06696	-0.06696	0.93304	1	1
32	2	2.00000	2.06696	0.06696	-0.06696	-0.06696	0	0
33	2	2.83333	3.00873	0.00873	-0.17540	-1.00873	-1	1
34	3	2.83333	3.00873	0.00873	-0.17540	-0.00873	0	0
35	3	4.00000	3.95051	-0.04949	0.04949	-0.95051	-1	1
36	4	4.00000	3.95051	-0.04949	0.04949	0.04949	0	0
37	4	4.00000	3.95051	-0.04949	0.04949	0.04949	0	0
38	3	2.83333	3.00873	0.00873	-0.17540	-0.00873	0	0
39	4	4.00000	3.95051	-0.04949	0.04949	0.04949	0	0
40	0	1.21429	1.12518	0.12518	0.08910	-1.12518	-1	1
41	1	1.21429	1.12518	0.12518	0.08910	-0.12518	0	0
42	1	1.21429	1.12518	0.12518	0.08910	-0.12518	0	0
43	2	1.21429	1.12518	0.12518	0.08910	0.87482	1	1
44	2	2.00000	2.06696	0.06696	-0.06696	-0.06696	0	0
45	1	2.00000	2.06696	0.06696	-0.06696	-1.06696	-1	1

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	2.99073	0.99073	0.9907	3	1	1
32	1.92890	-0.07110	0.0711	2	0	0
33	1.92890	-1.07110	1.0711	2	-1	1
34	2.99073	-0.00927	0.0093	3	0	0
35	2.99073	-1.00927	1.0093	3	-1	1
36	4.05255	0.05255	0.0526	4	0	0
37	4.05255	0.05255	0.0526	4	0	0
38	2.99073	-0.00927	0.0093	3	0	0
39	4.05255	0.05255	0.0526	4	0	0
40	-0.19474	-1.19474	1.1947	0	-1	1
41	0.86708	-0.13292	0.1329	1	0	0
42	0.86708	-0.13292	0.1329	1	0	0
43	1.92890	0.92890	0.9289	2	1	1
44	1.92890	-0.07110	0.0711	2	0	0
45	0.86708	-1.13292	1.1329	1	-1	1

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
46	0.000	1	0.5	0.65385	1	0	53	40.3846	2
47	21.381	2	1.0	0.65385	0	1	59	40.3846	2
48	14.277	2	1.0	0.61538	0	1	62	62.3846	4

49	12.344	2	1.0	0.61538	0	1	67	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
46	2	2.00000	2.06696	0.06696	-0.06696	-0.06696	0	0
47	2	2.00000	2.06696	0.06696	-0.06696	-0.06696	0	0
48	4	4.00000	3.95051	-0.04949	0.04949	0.04949	0	0
49	4	4.00000	3.95051	-0.04949	0.04949	0.04949	0	0
				2.00000	-0.00000	-0.00000	2	18

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
46	1.92890	-0.07110	0.0711	2	0	0
47	1.92890	-0.07110	0.0711	2	0	0
48	4.05255	0.05255	0.0526	4	0	0
49	4.05255	0.05255	0.0526	4	0	0
		-0.00000	21.2921		2	18

A G E R E A D I N G

Date - Time : 28SEP96 - 12:06:10
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD24.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD24LUN.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD24LUN.DP

Reader : 'READER 4 '
Number data records : 49

Dependent Variable : read
Independ. Variable/s: true rda (2)
Options (PROC REG) :
Size Def. : length > 38

Regression and Tests 2

Model: M1
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F

Model	2	81.18473	40.59237	264.477	0.0001
Error	46	7.06017	0.15348		
C Total	48	88.24490			

Root MSE	0.39177	R-square	0.9200
Dep Mean	2.48980	Adj R-sq	0.9165
C.V.	15.73493		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.257261	0.19384117	-1.327	0.1910
TRUE	1	0.966113	0.04299589	22.470	0.0001
RDA	1	0.622407	0.27003668	2.305	0.0257

Regression and Tests 3

Dependent Variable: READ

Test: T_TRUE Numerator: 0.0953 DF: 1 F value: 0.6212
Denominator: 0.153482 DF: 46 Prob>F: 0.4347

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
0	0.00000	0.50000	9.0000	.	1
1	1.14286	0.57143	23.1429	31.7744	14
2	2.00000	0.65385	40.3846	20.4124	13
3	3.00000	0.58333	52.8333	0.0000	6
4	3.92308	0.61538	62.3846	12.5806	13
5	5.50000	0.75000	70.5000	12.8565	2

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.000	1	0.5	0.57143	1	0	10	23.1429	1
2	31.427	1	0.5	0.57143	1	0	21	23.1429	1
3	26.726	2	1.0	0.65385	0	1	33	40.3846	2
4	20.574	1	0.5	0.65385	1	0	38	40.3846	2
5	20.574	1	0.5	0.65385	1	0	44	40.3846	2
6	14.277	1	0.5	0.61538	1	0	52	62.3846	4
7	11.314	1	0.5	0.58333	1	0	58	52.8333	3
8	16.798	1	0.5	0.75000	1	0	64	70.5000	5
9	11.830	1	0.5	0.61538	1	0	73	62.3846	4
10	16.833	2	1.0	0.75000	0	1	77	70.5000	5

11	37.033	1	0.5	0.57143	1	0	18	23.1429	1
12	16.638	1	0.5	0.65385	1	0	28	40.3846	2
13	20.574	1	0.5	0.65385	1	0	34	40.3846	2
14	14.243	1	0.5	0.58333	1	0	49	52.8333	3
15	20.940	1	0.5	0.61538	1	0	68	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.14286	1.02006	0.02006	0.12280	-0.02006	0	0
2	1	1.14286	1.02006	0.02006	0.12280	-0.02006	0	0
3	2	2.00000	2.29737	0.29737	-0.29737	-0.29737	0	0
4	2	2.00000	1.98617	-0.01383	0.01383	0.01383	0	0
5	2	2.00000	1.98617	-0.01383	0.01383	0.01383	0	0
6	3	3.92308	3.91840	-0.08160	0.00468	-0.91840	-1	1
7	3	3.00000	2.95228	-0.04772	0.04772	0.04772	0	0
8	5	5.50000	4.88451	-0.11549	0.61549	0.11549	0	0
9	4	3.92308	3.91840	-0.08160	0.00468	0.08160	0	0
10	6	5.50000	5.19571	0.19571	0.30429	0.80429	1	1
11	2	1.14286	1.02006	0.02006	0.12280	0.97994	1	1
12	2	2.00000	1.98617	-0.01383	0.01383	0.01383	0	0
13	2	2.00000	1.98617	-0.01383	0.01383	0.01383	0	0
14	3	3.00000	2.95228	-0.04772	0.04772	0.04772	0	0
15	4	3.92308	3.91840	-0.08160	0.00468	0.08160	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	0.97924	-0.02076	0.0208	1	0	0
2	0.97924	-0.02076	0.0208	1	0	0
3	1.69220	-0.30780	0.3078	2	0	0
4	2.01432	0.01432	0.0143	2	0	0
5	2.01432	0.01432	0.0143	2	0	0
6	3.04939	-0.95061	0.9506	3	-1	1
7	3.04939	0.04939	0.0494	3	0	0
8	5.11954	0.11954	0.1195	5	0	0
9	4.08447	0.08447	0.0845	4	0	0
10	5.83250	0.83250	0.8325	6	1	1
11	2.01432	1.01432	1.0143	2	1	1
12	2.01432	0.01432	0.0143	2	0	0
13	2.01432	0.01432	0.0143	2	0	0
14	3.04939	0.04939	0.0494	3	0	0
15	4.08447	0.08447	0.0845	4	0	0

Estim. of means, biases and dispersion 6

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	12.344	1	0.5	0.61538	1	0	80	62.3846	4
17	37.033	1	0.5	0.57143	1	0	19	23.1429	1
18	37.033	1	0.5	0.57143	1	0	22	23.1429	1
19	31.427	1	0.5	0.57143	1	0	28	23.1429	1
20	16.638	1	0.5	0.65385	1	0	33	40.3846	2
21	25.713	2	1.0	0.58333	0	1	39	52.8333	3

22	18.898	1	0.5	0.61538	1	0	44	62.3846	4
23	14.277	1	0.5	0.61538	1	0	49	62.3846	4
24	20.940	2	1.0	0.61538	0	1	52	62.3846	4
25	282.843	1	0.5	0.50000	1	0	9	9.0000	0
26	82.808	2	1.0	0.57143	0	1	13	23.1429	1
27	31.427	1	0.5	0.57143	1	0	18	23.1429	1
28	0.000	1	0.5	0.57143	1	0	24	23.1429	1
29	0.000	1	0.5	0.57143	1	0	28	23.1429	1
30	18.856	1	0.5	0.65385	1	0	34	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	4	3.92308	3.91840	-0.08160	0.00468	0.08160	0	0
17	1	1.14286	1.02006	0.02006	0.12280	-0.02006	0	0
18	1	1.14286	1.02006	0.02006	0.12280	-0.02006	0	0
19	1	1.14286	1.02006	0.02006	0.12280	-0.02006	0	0
20	2	2.00000	1.98617	-0.01383	0.01383	0.01383	0	0
21	3	3.00000	3.26349	0.26349	-0.26349	-0.26349	0	0
22	4	3.92308	3.91840	-0.08160	0.00468	0.08160	0	0
23	4	3.92308	3.91840	-0.08160	0.00468	0.08160	0	0
24	5	3.92308	4.22960	0.22960	-0.30652	0.77040	1	1
25	0	0.00000	0.05394	0.05394	-0.05394	-0.05394	0	0
26	1	1.14286	1.33126	0.33126	-0.18840	-0.33126	0	0
27	1	1.14286	1.02006	0.02006	0.12280	-0.02006	0	0
28	1	1.14286	1.02006	0.02006	0.12280	-0.02006	0	0
29	1	1.14286	1.02006	0.02006	0.12280	-0.02006	0	0
30	2	2.00000	1.98617	-0.01383	0.01383	0.01383	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	4.08447	0.08447	0.0845	4	0	0
17	0.97924	-0.02076	0.0208	1	0	0
18	0.97924	-0.02076	0.0208	1	0	0
19	0.97924	-0.02076	0.0208	1	0	0
20	2.01432	0.01432	0.0143	2	0	0
21	2.72727	-0.27273	0.2727	3	0	0
22	4.08447	0.08447	0.0845	4	0	0
23	4.08447	0.08447	0.0845	4	0	0
24	4.79742	0.79742	0.7974	5	1	1
25	-0.05583	-0.05583	0.0558	0	0	0
26	0.65712	-0.34288	0.3429	1	0	0
27	0.97924	-0.02076	0.0208	1	0	0
28	0.97924	-0.02076	0.0208	1	0	0
29	0.97924	-0.02076	0.0208	1	0	0
30	2.01432	0.01432	0.0143	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	30.159	1	0.5	0.65385	1	0	35	40.3846	2
32	26.726	2	1.0	0.65385	0	1	41	40.3846	2

33	16.833	1	0.5	0.58333	1	0	47	52.8333	3
34	0.000	1	0.5	0.58333	1	0	54	52.8333	3
35	18.856	1	0.5	0.61538	1	0	58	62.3846	4
36	13.363	1	0.5	0.61538	1	0	60	62.3846	4
37	9.124	1	0.5	0.61538	1	0	68	62.3846	4
38	14.243	1	0.5	0.58333	1	0	70	52.8333	3
39	8.571	2	1.0	0.61538	0	1	78	62.3846	4
40	61.721	1	0.5	0.57143	1	0	23	23.1429	1
41	0.000	1	0.5	0.57143	1	0	28	23.1429	1
42	0.000	1	0.5	0.57143	1	0	34	23.1429	1
43	35.635	2	1.0	0.57143	0	1	38	23.1429	1
44	0.000	1	0.5	0.65385	1	0	44	40.3846	2
45	31.849	2	1.0	0.65385	0	1	49	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.00000	1.98617	-0.01383	0.01383	0.01383	0	0
32	2	2.00000	2.29737	0.29737	-0.29737	-0.29737	0	0
33	3	3.00000	2.95228	-0.04772	0.04772	0.04772	0	0
34	3	3.00000	2.95228	-0.04772	0.04772	0.04772	0	0
35	4	3.92308	3.91840	-0.08160	0.00468	0.08160	0	0
36	4	3.92308	3.91840	-0.08160	0.00468	0.08160	0	0
37	4	3.92308	3.91840	-0.08160	0.00468	0.08160	0	0
38	3	3.00000	2.95228	-0.04772	0.04772	0.04772	0	0
39	4	3.92308	4.22960	0.22960	-0.30652	-0.22960	0	0
40	1	1.14286	1.02006	0.02006	0.12280	-0.02006	0	0
41	1	1.14286	1.02006	0.02006	0.12280	-0.02006	0	0
42	1	1.14286	1.02006	0.02006	0.12280	-0.02006	0	0
43	2	1.14286	1.33126	0.33126	-0.18840	0.66874	1	1
44	2	2.00000	1.98617	-0.01383	0.01383	0.01383	0	0
45	1	2.00000	2.29737	0.29737	-0.29737	-1.29737	-1	1

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	2.01432	0.01432	0.0143	2	0	0
32	1.69220	-0.30780	0.3078	2	0	0
33	3.04939	0.04939	0.0494	3	0	0
34	3.04939	0.04939	0.0494	3	0	0
35	4.08447	0.08447	0.0845	4	0	0
36	4.08447	0.08447	0.0845	4	0	0
37	4.08447	0.08447	0.0845	4	0	0
38	3.04939	0.04939	0.0494	3	0	0
39	3.76235	-0.23765	0.2377	4	0	0
40	0.97924	-0.02076	0.0208	1	0	0
41	0.97924	-0.02076	0.0208	1	0	0
42	0.97924	-0.02076	0.0208	1	0	0
43	1.69220	0.69220	0.6922	2	1	1
44	2.01432	0.01432	0.0143	2	0	0
45	0.65712	-1.34288	1.3429	1	-1	1

Estim. of means, biases and dispersion 8

Otol.	Otol.	Readability of	Inverted Average Readab. of	Average Readab. of	Good	Worse	Fish	Average Fish	True Age

No.	Uncert.	Otol.	Otol.	Otol.	Readab.	Readab.	Length	Length Class
46	0.000	1	0.5	0.65385	1	0	53	40.3846 2
47	21.381	2	1.0	0.65385	0	1	59	40.3846 2
48	14.277	1	0.5	0.61538	1	0	62	62.3846 4
49	12.344	2	1.0	0.61538	0	1	67	62.3846 4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
46	2	2.00000	1.98617	-0.01383	0.01383	0.01383	0	0
47	3	2.00000	2.29737	0.29737	-0.29737	0.70263	1	1
48	3	3.92308	3.91840	-0.08160	0.00468	-0.91840	-1	1
49	4	3.92308	4.22960	0.22960	-0.30652	-0.22960	0	0
				2.00000	-0.00000	0.00000	2	8

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
46	2.01432	0.01432	0.0143	2	0	0
47	2.72727	0.72727	0.7273	3	1	1
48	3.04939	-0.95061	0.9506	3	-1	1
49	3.76235	-0.23765	0.2377	4	0	0
		0.00000	10.4696		2	8

A G E R E A D I N G

Date - Time : 28SEP96 - 12:06:29
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD24.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD24POU.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD24POU.DP

Reader : 'READER 5 '
Number data records : 49

Dependent Variable : read
Independ. Variable/s: true (1)
Options (PROC REG) : noint
Size Def. : length > 38

Regression and Tests 2

Model: M1
NOTE: No intercept in model. R-square is redefined.

Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	362.16931	362.16931	3598.686	0.0001
Error	48	4.83069	0.10064		
U Total	49	367.00000			

Root MSE	0.31724	R-square	0.9868
Dep Mean	2.38776	Adj R-sq	0.9866
C.V.	13.28600		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
TRUE	1	0.978836	0.01631691	59.989	0.0001

Regression and Tests 3

Dependent Variable: READ

Test: T_TRUE	Numerator:	0.1693	DF:	1	F value:	1.6824
	Denominator:	0.100639	DF:	48	Prob>F:	0.2008

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
0	0.00000	0.50000	9.0000	.	1
1	0.92857	0.50000	23.1429	28.7820	14
2	1.92308	0.53846	40.3846	14.4222	13
3	3.16667	0.50000	52.8333	12.8921	6
4	3.84615	0.57692	62.3846	9.7639	13
5	5.00000	0.50000	70.5000	0.0000	2

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.000	1	0.5	0.50000	1	0	10	23.1429	1
2	31.427	1	0.5	0.50000	1	0	21	23.1429	1
3	26.726	1	0.5	0.53846	1	0	33	40.3846	2
4	20.574	1	0.5	0.53846	1	0	38	40.3846	2
5	20.574	1	0.5	0.53846	1	0	44	40.3846	2
6	14.277	1	0.5	0.57692	1	0	52	62.3846	4

7	11.314	1	0.5	0.50000	1	0	58	52.8333	3
8	16.798	1	0.5	0.50000	1	0	64	70.5000	5
9	11.830	1	0.5	0.57692	1	0	73	62.3846	4
10	16.833	1	0.5	0.50000	1	0	77	70.5000	5
11	37.033	1	0.5	0.50000	1	0	18	23.1429	1
12	16.638	1	0.5	0.53846	1	0	28	40.3846	2
13	20.574	1	0.5	0.53846	1	0	34	40.3846	2
14	14.243	1	0.5	0.50000	1	0	49	52.8333	3
15	20.940	2	1.0	0.57692	0	1	68	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
2	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
3	2	1.92308	1.95767	-0.04233	-0.03460	0.04233	0	0
4	2	1.92308	1.95767	-0.04233	-0.03460	0.04233	0	0
5	2	1.92308	1.95767	-0.04233	-0.03460	0.04233	0	0
6	4	3.84615	3.91534	-0.08466	-0.06919	0.08466	0	0
7	3	3.16667	2.93651	-0.06349	0.23016	0.06349	0	0
8	5	5.00000	4.89418	-0.10582	0.10582	0.10582	0	0
9	4	3.84615	3.91534	-0.08466	-0.06919	0.08466	0	0
10	5	5.00000	4.89418	-0.10582	0.10582	0.10582	0	0
11	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
12	2	1.92308	1.95767	-0.04233	-0.03460	0.04233	0	0
13	2	1.92308	1.95767	-0.04233	-0.03460	0.04233	0	0
14	4	3.16667	2.93651	-0.06349	0.23016	1.06349	1	1
15	4	3.84615	3.91534	-0.08466	-0.06919	0.08466	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	1.02162	0.02162	0.02162	1	0	0
2	1.02162	0.02162	0.02162	1	0	0
3	2.04324	0.04324	0.04324	2	0	0
4	2.04324	0.04324	0.04324	2	0	0
5	2.04324	0.04324	0.04324	2	0	0
6	4.08649	0.08649	0.08649	4	0	0
7	3.06486	0.06486	0.06486	3	0	0
8	5.10811	0.10811	0.10811	5	0	0
9	4.08649	0.08649	0.08649	4	0	0
10	5.10811	0.10811	0.10811	5	0	0
11	1.02162	0.02162	0.02162	1	0	0
12	2.04324	0.04324	0.04324	2	0	0
13	2.04324	0.04324	0.04324	2	0	0
14	4.08649	1.08649	1.08649	4	1	1
15	4.08649	0.08649	0.08649	4	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	12.344	1	0.5	0.57692	1	0	80	62.3846	4
17	37.033	1	0.5	0.50000	1	0	19	23.1429	1

18	37.033	1	0.5	0.50000	1	0	22	23.1429	1
19	31.427	1	0.5	0.50000	1	0	28	23.1429	1
20	16.638	1	0.5	0.53846	1	0	33	40.3846	2
21	25.713	1	0.5	0.50000	1	0	39	52.8333	3
22	18.898	2	1.0	0.57692	0	1	44	62.3846	4
23	14.277	1	0.5	0.57692	1	0	49	62.3846	4
24	20.940	1	0.5	0.57692	1	0	52	62.3846	4
25	282.843	1	0.5	0.50000	1	0	9	9.0000	0
26	82.808	1	0.5	0.50000	1	0	13	23.1429	1
27	31.427	1	0.5	0.50000	1	0	18	23.1429	1
28	0.000	1	0.5	0.50000	1	0	24	23.1429	1
29	0.000	1	0.5	0.50000	1	0	28	23.1429	1
30	18.856	1	0.5	0.53846	1	0	34	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	3	3.84615	3.91534	-0.08466	-0.06919	-0.91534	-1	1
17	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
18	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
19	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
20	2	1.92308	1.95767	-0.04233	-0.03460	0.04233	0	0
21	3	3.16667	2.93651	-0.06349	0.23016	0.06349	0	0
22	4	3.84615	3.91534	-0.08466	-0.06919	0.08466	0	0
23	4	3.84615	3.91534	-0.08466	-0.06919	0.08466	0	0
24	3	3.84615	3.91534	-0.08466	-0.06919	-0.91534	-1	1
25	0	0.00000	0.00000	0.00000	0.00000	0.00000	0	0
26	0	0.92857	0.97884	-0.02116	-0.05026	-0.97884	-1	1
27	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
28	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
29	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
30	2	1.92308	1.95767	-0.04233	-0.03460	0.04233	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	3.06486	-0.93514	0.93514	3	-1	1
17	1.02162	0.02162	0.02162	1	0	0
18	1.02162	0.02162	0.02162	1	0	0
19	1.02162	0.02162	0.02162	1	0	0
20	2.04324	0.04324	0.04324	2	0	0
21	3.06486	0.06486	0.06486	3	0	0
22	4.08649	0.08649	0.08649	4	0	0
23	4.08649	0.08649	0.08649	4	0	0
24	3.06486	-0.93514	0.93514	3	-1	1
25	0.00000	0.00000	0.00000	0	0	0
26	0.00000	-1.00000	1.00000	0	-1	1
27	1.02162	0.02162	0.02162	1	0	0
28	1.02162	0.02162	0.02162	1	0	0
29	1.02162	0.02162	0.02162	1	0	0
30	2.04324	0.04324	0.04324	2	0	0

Estim. of means, biases and dispersion 7

Otol.	Otol.	Readability of	Inverted Readab. of	Average Readab. of	Good	Worse	Fish	Average Fish	True Age

No.	Uncert.	Otol.	Otol.	Otol.	Readab.	Readab.	Length	Length	Class
31	30.159	1	0.5	0.53846	1	0	35	40.3846	2
32	26.726	1	0.5	0.53846	1	0	41	40.3846	2
33	16.833	1	0.5	0.50000	1	0	47	52.8333	3
34	0.000	1	0.5	0.50000	1	0	54	52.8333	3
35	18.856	1	0.5	0.57692	1	0	58	62.3846	4
36	13.363	1	0.5	0.57692	1	0	60	62.3846	4
37	9.124	1	0.5	0.57692	1	0	68	62.3846	4
38	14.243	1	0.5	0.50000	1	0	70	52.8333	3
39	8.571	1	0.5	0.57692	1	0	78	62.3846	4
40	61.721	1	0.5	0.50000	1	0	23	23.1429	1
41	0.000	1	0.5	0.50000	1	0	28	23.1429	1
42	0.000	1	0.5	0.50000	1	0	34	23.1429	1
43	35.635	1	0.5	0.50000	1	0	38	23.1429	1
44	0.000	1	0.5	0.53846	1	0	44	40.3846	2
45	31.849	1	0.5	0.53846	1	0	49	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	1	1.92308	1.95767	-0.04233	-0.03460	-0.95767	-1	1
32	2	1.92308	1.95767	-0.04233	-0.03460	0.04233	0	0
33	3	3.16667	2.93651	-0.06349	0.23016	0.06349	0	0
34	3	3.16667	2.93651	-0.06349	0.23016	0.06349	0	0
35	4	3.84615	3.91534	-0.08466	-0.06919	0.08466	0	0
36	4	3.84615	3.91534	-0.08466	-0.06919	0.08466	0	0
37	4	3.84615	3.91534	-0.08466	-0.06919	0.08466	0	0
38	3	3.16667	2.93651	-0.06349	0.23016	0.06349	0	0
39	4	3.84615	3.91534	-0.08466	-0.06919	0.08466	0	0
40	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
41	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
42	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
43	1	0.92857	0.97884	-0.02116	-0.05026	0.02116	0	0
44	2	1.92308	1.95767	-0.04233	-0.03460	0.04233	0	0
45	2	1.92308	1.95767	-0.04233	-0.03460	0.04233	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	1.02162	-0.97838	0.97838	1	-1	1
32	2.04324	0.04324	0.04324	2	0	0
33	3.06486	0.06486	0.06486	3	0	0
34	3.06486	0.06486	0.06486	3	0	0
35	4.08649	0.08649	0.08649	4	0	0
36	4.08649	0.08649	0.08649	4	0	0
37	4.08649	0.08649	0.08649	4	0	0
38	3.06486	0.06486	0.06486	3	0	0
39	4.08649	0.08649	0.08649	4	0	0
40	1.02162	0.02162	0.02162	1	0	0
41	1.02162	0.02162	0.02162	1	0	0
42	1.02162	0.02162	0.02162	1	0	0
43	1.02162	0.02162	0.02162	1	0	0
44	2.04324	0.04324	0.04324	2	0	0
45	2.04324	0.04324	0.04324	2	0	0

Estim. of means, biases and dispersion 8

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Average Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
46	0.000	1	0.5	0.53846	1	0	53	40.3846	2
47	21.381	2	1.0	0.53846	0	1	59	40.3846	2
48	14.277	1	0.5	0.57692	1	0	62	62.3846	4
49	12.344	1	0.5	0.57692	1	0	67	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
46	2	1.92308	1.95767	-0.04233	-0.03460	0.04233	0	0
47	2	1.92308	1.95767	-0.04233	-0.03460	0.04233	0	0
48	4	3.84615	3.91534	-0.08466	-0.06919	0.08466	0	0
49	4	3.84615	3.91534	-0.08466	-0.06919	0.08466	0	0
				-2.53968	-0.46032	-0.46032	-3	5

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
46	2.04324	0.04324	0.04324	2	0	0
47	2.04324	0.04324	0.04324	2	0	0
48	4.08649	0.08649	0.08649	4	0	0
49	4.08649	0.08649	0.08649	4	0	0
		-0.47027	7.22703		-3	5

A G E R E A D I N G

Date - Time : 28SEP96 - 12:06:48
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD24.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD24SJO.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD24SJO.DP

Reader : 'READER 6'
Number data records : 49

Dependent Variable : read
Independ. Variable/s: true rda_good length (3)
Options (PROC REG) : noint
Size Def. : length > 38

Regression and Tests 2

Model: M1
NOTE: No intercept in model. R-square is redefined.
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	3	398.81398	132.93799	2797.387	0.0001
Error	46	2.18602	0.04752		
U Total	49	401.00000			

Root MSE	0.21800	R-square	0.9945
Dep Mean	2.51020	Adj R-sq	0.9942
C.V.	8.68439		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
TRUE	1	0.895214	0.04876843	18.356	0.0001
RDA_GOOD	1	-0.109128	0.05105222	-2.138	0.0379
LENGTH	1	0.009386	0.00298117	3.148	0.0029

Regression and Tests 3

Dependent Variable: READ
Test: T_TRUE Numerator: 0.2194 DF: 1 F value: 4.6166
Denominator: 0.047522 DF: 46 Prob>F: 0.0370

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
0	0.00000	0.50000	9.0000	.	1
1	1.00000	0.53571	23.1429	0.0000	14
2	2.07692	0.53846	40.3846	13.3539	13
3	3.00000	0.58333	52.8333	0.0000	6
4	4.15385	0.73077	62.3846	9.0406	13
5	5.00000	0.75000	70.5000	0.0000	2

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.000	1	0.5	0.53571	1	0	10	23.1429	1

2	31.427	1	0.5	0.53571	1	0	21	23.1429	1
3	26.726	1	0.5	0.53846	1	0	33	40.3846	2
4	20.574	1	0.5	0.53846	1	0	38	40.3846	2
5	20.574	1	0.5	0.53846	1	0	44	40.3846	2
6	14.277	2	1.0	0.73077	0	1	52	62.3846	4
7	11.314	1	0.5	0.58333	1	0	58	52.8333	3
8	16.798	1	0.5	0.75000	1	0	64	70.5000	5
9	11.830	1	0.5	0.73077	1	0	73	62.3846	4
10	16.833	2	1.0	0.75000	0	1	77	70.5000	5
11	37.033	1	0.5	0.53571	1	0	18	23.1429	1
12	16.638	1	0.5	0.53846	1	0	28	40.3846	2
13	20.574	1	0.5	0.53846	1	0	34	40.3846	2
14	14.243	1	0.5	0.58333	1	0	49	52.8333	3
15	20.940	2	1.0	0.73077	0	1	68	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.00000	0.87994	-0.12006	0.12006	0.12006	0	0
2	1	1.00000	0.98318	-0.01682	0.01682	0.01682	0	0
3	2	2.07692	1.99102	-0.00898	0.08590	0.00898	0	0
4	2	2.07692	2.03795	0.03795	0.03897	-0.03795	0	0
5	2	2.07692	2.09426	0.09426	-0.01734	-0.09426	0	0
6	4	4.15385	4.06891	0.06891	0.08494	-0.06891	0	0
7	3	3.00000	3.12088	0.12088	-0.12088	-0.12088	0	0
8	5	5.00000	4.96762	-0.03238	0.03238	0.03238	0	0
9	5	4.15385	4.15687	0.15687	-0.00303	0.84313	1	1
10	5	5.00000	5.19876	0.19876	-0.19876	-0.19876	0	0
11	1	1.00000	0.95503	-0.04497	0.04497	0.04497	0	0
12	2	2.07692	1.94410	-0.05590	0.13283	0.05590	0	0
13	2	2.07692	2.00041	0.00041	0.07651	-0.00041	0	0
14	3	3.00000	3.03641	0.03641	-0.03641	-0.03641	0	0
15	4	4.15385	4.21907	0.21907	-0.06523	-0.21907	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	1.13411	0.13411	0.13411	1	0	0
2	1.01879	0.01879	0.01879	1	0	0
3	2.01003	0.01003	0.01003	2	0	0
4	1.95761	-0.04239	0.04239	2	0	0
5	1.89470	-0.10530	0.10530	2	0	0
6	3.92303	-0.07697	0.07697	4	0	0
7	2.86498	-0.13502	0.13502	3	0	0
8	5.03617	0.03617	0.03617	5	0	0
9	4.94182	0.94182	0.94182	5	1	1
10	4.77798	-0.22202	0.22202	5	0	0
11	1.05024	0.05024	0.05024	1	0	0
12	2.06245	0.06245	0.06245	2	0	0
13	1.99954	-0.00046	0.00046	2	0	0
14	2.95933	-0.04067	0.04067	3	0	0
15	3.75528	-0.24472	0.24472	4	0	0

Estim. of means, biases and dispersion 6

Readability	Inverted Readab.	Average Readab.	Average	True

Otol. No.	Otol. Uncert.	of Otol.	of Otol.	of Otol.	Good Readab.	Worse Readab.	Fish Length	Fish Length	Age Class
16	12.344	2	1.0	0.73077	0	1	80	62.3846	4
17	37.033	1	0.5	0.53571	1	0	19	23.1429	1
18	37.033	1	0.5	0.53571	1	0	22	23.1429	1
19	31.427	1	0.5	0.53571	1	0	28	23.1429	1
20	16.638	1	0.5	0.53846	1	0	33	40.3846	2
21	25.713	1	0.5	0.58333	1	0	39	52.8333	3
22	18.898	2	1.0	0.73077	0	1	44	62.3846	4
23	14.277	1	0.5	0.73077	1	0	49	62.3846	4
24	20.940	2	1.0	0.73077	0	1	52	62.3846	4
25	282.843	1	0.5	0.50000	1	0	9	9.0000	0
26	82.808	1	0.5	0.53571	1	0	13	23.1429	1
27	31.427	1	0.5	0.53571	1	0	18	23.1429	1
28	0.000	1	0.5	0.53571	1	0	24	23.1429	1
29	0.000	1	0.5	0.53571	1	0	28	23.1429	1
30	18.856	1	0.5	0.53846	1	0	34	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	4	4.15385	4.33170	0.33170	-0.17785	-0.33170	0	0
17	1	1.00000	0.96441	-0.03559	0.03559	0.03559	0	0
18	1	1.00000	0.99257	-0.00743	0.00743	0.00743	0	0
19	1	1.00000	1.04888	0.04888	-0.04888	-0.04888	0	0
20	2	2.07692	1.99102	-0.00898	0.08590	0.00898	0	0
21	3	3.00000	2.94255	-0.05745	0.05745	0.05745	0	0
22	4	4.15385	3.99382	-0.00618	0.16003	0.00618	0	0
23	4	4.15385	3.93162	-0.06838	0.22223	0.06838	0	0
24	4	4.15385	4.06891	0.06891	0.08494	-0.06891	0	0
25	0	0.00000	-0.02466	-0.02466	0.02466	0.02466	0	0
26	1	1.00000	0.90810	-0.09190	0.09190	0.09190	0	0
27	1	1.00000	0.95503	-0.04497	0.04497	0.04497	0	0
28	1	1.00000	1.01134	0.01134	-0.01134	-0.01134	0	0
29	1	1.00000	1.04888	0.04888	-0.04888	-0.04888	0	0
30	2	2.07692	2.00041	0.00041	0.07651	-0.00041	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	3.62947	-0.37053	0.37053	4	0	0
17	1.03975	0.03975	0.03975	1	0	0
18	1.00830	0.00830	0.00830	1	0	0
19	0.94540	-0.05460	0.05460	1	0	0
20	2.01003	0.01003	0.01003	2	0	0
21	3.06417	0.06417	0.06417	3	0	0
22	4.00690	0.00690	0.00690	4	0	0
23	4.07638	0.07638	0.07638	4	0	0
24	3.92303	-0.07697	0.07697	4	0	0
25	0.02754	0.02754	0.02754	0	0	0
26	1.10266	0.10266	0.10266	1	0	0
27	1.05024	0.05024	0.05024	1	0	0
28	0.98733	-0.01267	0.01267	1	0	0
29	0.94540	-0.05460	0.05460	1	0	0
30	1.99954	-0.00046	0.00046	2	0	0

Estim. of means, biases and dispersion 7

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	30.159	1	0.5	0.53846	1	0	35	40.3846	2
32	26.726	1	0.5	0.53846	1	0	41	40.3846	2
33	16.833	1	0.5	0.58333	1	0	47	52.8333	3
34	0.000	1	0.5	0.58333	1	0	54	52.8333	3
35	18.856	1	0.5	0.73077	1	0	58	62.3846	4
36	13.363	1	0.5	0.73077	1	0	60	62.3846	4
37	9.124	1	0.5	0.73077	1	0	68	62.3846	4
38	14.243	2	1.0	0.58333	0	1	70	52.8333	3
39	8.571	2	1.0	0.73077	0	1	78	62.3846	4
40	61.721	1	0.5	0.53571	1	0	23	23.1429	1
41	0.000	1	0.5	0.53571	1	0	28	23.1429	1
42	0.000	1	0.5	0.53571	1	0	34	23.1429	1
43	35.635	2	1.0	0.53571	0	1	38	23.1429	1
44	0.000	1	0.5	0.53846	1	0	44	40.3846	2
45	31.849	1	0.5	0.53846	1	0	49	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.07692	2.00979	0.00979	0.06713	-0.00979	0	0
32	2	2.07692	2.06611	0.06611	0.01082	-0.06611	0	0
33	3	3.00000	3.01764	0.01764	-0.01764	-0.01764	0	0
34	3	3.00000	3.08333	0.08333	-0.08333	-0.08333	0	0
35	4	4.15385	4.01609	0.01609	0.13776	-0.01609	0	0
36	4	4.15385	4.03486	0.03486	0.11898	-0.03486	0	0
37	4	4.15385	4.10995	0.10995	0.04390	-0.10995	0	0
38	3	3.00000	3.34263	0.34263	-0.34263	-0.34263	0	0
39	5	4.15385	4.31293	0.31293	-0.15908	0.68707	1	1
40	1	1.00000	1.00195	0.00195	-0.00195	-0.00195	0	0
41	1	1.00000	1.04888	0.04888	-0.04888	-0.04888	0	0
42	1	1.00000	1.10519	0.10519	-0.10519	-0.10519	0	0
43	1	1.00000	1.25186	0.25186	-0.25186	-0.25186	0	0
44	2	2.07692	2.09426	0.09426	-0.01734	-0.09426	0	0
45	2	2.07692	2.14119	0.14119	-0.06427	-0.14119	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	1.98906	-0.01094	0.01094	2	0	0
32	1.92615	-0.07385	0.07385	2	0	0
33	2.98030	-0.01970	0.01970	3	0	0
34	2.90691	-0.09309	0.09309	3	0	0
35	3.98203	-0.01797	0.01797	4	0	0
36	3.96106	-0.03894	0.03894	4	0	0
37	3.87718	-0.12282	0.12282	4	0	0
38	2.61726	-0.38274	0.38274	3	0	0
39	4.76749	0.76749	0.76749	5	1	1
40	0.99782	-0.00218	0.00218	1	0	0
41	0.94540	-0.05460	0.05460	1	0	0
42	0.88249	-0.11751	0.11751	1	0	0
43	0.71865	-0.28135	0.28135	1	0	0
44	1.89470	-0.10530	0.10530	2	0	0

45	1.84228	-0.15772	0.15772	2	0	0

Estim. of means, biases and dispersion 8

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Average Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
46	0.000	1	0.5	0.53846	1	0	53	40.3846	2
47	21.381	2	1.0	0.53846	0	1	59	40.3846	2
48	14.277	1	0.5	0.73077	1	0	62	62.3846	4
49	12.344	1	0.5	0.73077	1	0	67	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Read Age - Residuals	Read Age - True Age	|Read Age - True Age|
46	2	2.07692	2.17873	0.17873	-0.10181	-0.17873	0	0
47	3	2.07692	2.34418	0.34418	-0.26725	0.65582	1	1
48	4	4.15385	4.05363	0.05363	0.10021	-0.05363	0	0
49	4	4.15385	4.10056	0.10056	0.05329	-0.10056	0	0
				3.13277	-0.13277	-0.13277	3	3

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
46	1.80034	-0.19966	0.19966	2	0	0
47	2.73259	0.73259	0.73259	3	1	1
48	3.94009	-0.05991	0.05991	4	0	0
49	3.88767	-0.11233	0.11233	4	0	0
		-0.14831	6.42764		3	3

A G E R E A D I N G

Date - Time : 28SEP96 - 12:07:07
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD24.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD24ULR.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD24ULR.DP

Reader : 'READER 7 '
Number data records : 49

Dependent Variable : read
Independ. Variable/s: true quarter (2)
Options (PROC REG) :
Size Def. : length > 38

Regression and Tests 2

Model: M1
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	99.89931	49.94965	118.645	0.0001
Error	46	19.36600	0.42100		
C Total	48	119.26531			

Root MSE	0.64885	R-square	0.8376
Dep Mean	2.87755	Adj R-sq	0.8306
C.V.	22.54852		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	1.028854	0.30982989	3.321	0.0018
TRUE	1	1.014005	0.07262115	13.963	0.0001
QUARTER	1	-0.265765	0.08349858	-3.183	0.0026

Regression and Tests 3

Dependent Variable: READ

Test: T_TRUE	Numerator:	0.0157	DF:	1	F value:	0.0372
	Denominator:	0.421	DF:	46	Prob>F:	0.8479

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
0	0.00000	1.00000	9.0000	.	1
1	1.28571	0.60714	23.1429	47.5417	14
2	2.53846	0.73077	40.3846	20.4405	13
3	3.50000	0.66667	52.8333	15.6492	6
4	4.38462	0.69231	62.3846	21.9123	13
5	6.00000	0.75000	70.5000	23.5702	2

Estim. of means, biases and dispersion 5

Otol.	Otol. Readability of	Inverted Otol. Readab. of	Average Readab. of	Good	Worse	Fish	Average Fish	True Age

No.	Uncert.	Otol.	Otol.	Otol.	Readab.	Readab.	Length	Length	Class
1	0.000	1	0.5	0.60714	1	0	10	23.1429	1
2	31.427	1	0.5	0.60714	1	0	21	23.1429	1
3	26.726	2	1.0	0.73077	0	1	33	40.3846	2
4	20.574	1	0.5	0.73077	1	0	38	40.3846	2
5	20.574	2	1.0	0.73077	0	1	44	40.3846	2
6	14.277	1	0.5	0.69231	1	0	52	62.3846	4
7	11.314	1	0.5	0.66667	1	0	58	52.8333	3
8	16.798	1	0.5	0.75000	1	0	64	70.5000	5
9	11.830	2	1.0	0.69231	0	1	73	62.3846	4
10	16.833	2	1.0	0.75000	0	1	77	70.5000	5
11	37.033	2	1.0	0.60714	0	1	18	23.1429	1
12	16.638	1	0.5	0.73077	1	0	28	40.3846	2
13	20.574	1	0.5	0.73077	1	0	34	40.3846	2
14	14.243	2	1.0	0.66667	0	1	49	52.8333	3
15	20.940	2	1.0	0.69231	0	1	68	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Read Age - Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.28571	1.77709	0.7771	-0.49138	-0.77709	0	0
2	1	1.28571	1.77709	0.7771	-0.49138	-0.77709	0	0
3	2	2.53846	2.79110	0.7911	-0.25264	-0.79110	0	0
4	3	2.53846	2.79110	0.7911	-0.25264	0.20890	1	1
5	3	2.53846	2.79110	0.7911	-0.25264	0.20890	1	1
6	4	4.38462	4.81911	0.8191	-0.43450	-0.81911	0	0
7	4	3.50000	3.80511	0.8051	-0.30511	0.19489	1	1
8	5	6.00000	5.83312	0.8331	0.16688	-0.83312	0	0
9	4	4.38462	4.81911	0.8191	-0.43450	-0.81911	0	0
10	7	6.00000	5.83312	0.8331	0.16688	1.16688	2	2
11	2	1.28571	1.77709	0.7771	-0.49138	0.22291	1	1
12	3	2.53846	2.79110	0.7911	-0.25264	0.20890	1	1
13	3	2.53846	2.79110	0.7911	-0.25264	0.20890	1	1
14	3	3.50000	3.80511	0.8051	-0.30511	-0.80511	0	0
15	6	4.38462	4.81911	0.8191	-0.43450	1.18089	2	2

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	0.23364	-0.76636	0.7664	0	-1	1
2	0.23364	-0.76636	0.7664	0	-1	1
3	1.21983	-0.78017	0.7802	1	-1	1
4	2.20601	0.20601	0.2060	2	0	0
5	2.20601	0.20601	0.2060	2	0	0
6	3.19220	-0.80780	0.8078	3	-1	1
7	3.19220	0.19220	0.1922	3	0	0
8	4.17839	-0.82161	0.8216	4	-1	1
9	3.19220	-0.80780	0.8078	3	-1	1
10	6.15077	1.15077	1.1508	6	1	1
11	1.21983	0.21983	0.2198	1	0	0
12	2.20601	0.20601	0.2060	2	0	0
13	2.20601	0.20601	0.2060	2	0	0
14	2.20601	-0.79399	0.7940	2	-1	1
15	5.16458	1.16458	1.1646	5	1	1

Estim. of means, biases and dispersion 6

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	12.344	2	1.0	0.69231	0	1	80	62.3846	4
17	37.033	1	0.5	0.60714	1	0	19	23.1429	1
18	37.033	1	0.5	0.60714	1	0	22	23.1429	1
19	31.427	1	0.5	0.60714	1	0	28	23.1429	1
20	16.638	1	0.5	0.73077	1	0	33	40.3846	2
21	25.713	1	0.5	0.66667	1	0	39	52.8333	3
22	18.898	1	0.5	0.69231	1	0	44	62.3846	4
23	14.277	1	0.5	0.69231	1	0	49	62.3846	4
24	20.940	2	1.0	0.69231	0	1	52	62.3846	4
25	282.843	2	1.0	1.00000	0	1	9	9.0000	0
26	82.808	2	1.0	0.60714	0	1	13	23.1429	1
27	31.427	2	1.0	0.60714	0	1	18	23.1429	1
28	0.000	1	0.5	0.60714	1	0	24	23.1429	1
29	0.000	1	0.5	0.60714	1	0	28	23.1429	1
30	18.856	1	0.5	0.73077	1	0	34	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	4	4.38462	4.81911	0.8191	-0.43450	-0.81911	0	0
17	2	1.28571	1.51133	0.5113	-0.22562	0.48867	1	1
18	2	1.28571	1.51133	0.5113	-0.22562	0.48867	1	1
19	2	1.28571	1.51133	0.5113	-0.22562	0.48867	1	1
20	3	2.53846	2.52534	0.5253	0.01313	0.47466	1	1
21	4	3.50000	3.53934	0.5393	-0.03934	0.46066	1	1
22	5	4.38462	4.55335	0.5533	-0.16873	0.44665	1	1
23	4	4.38462	4.55335	0.5533	-0.16873	-0.55335	0	0
24	6	4.38462	4.55335	0.5533	-0.16873	1.44665	2	2
25	0	0.00000	0.23156	0.2316	-0.23156	-0.23156	0	0
26	1	1.28571	1.24556	0.2456	0.04015	-0.24556	0	0
27	1	1.28571	1.24556	0.2456	0.04015	-0.24556	0	0
28	1	1.28571	1.24556	0.2456	0.04015	-0.24556	0	0
29	1	1.28571	1.24556	0.2456	0.04015	-0.24556	0	0
30	2	2.53846	2.25957	0.2596	0.27889	-0.25957	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	3.19220	-0.80780	0.8078	3	-1	1
17	1.48192	0.48192	0.4819	1	0	0
18	1.48192	0.48192	0.4819	1	0	0
19	1.48192	0.48192	0.4819	1	0	0
20	2.46811	0.46811	0.4681	2	0	0
21	3.45430	0.45430	0.4543	3	0	0
22	4.44048	0.44048	0.4405	4	0	0
23	3.45430	-0.54570	0.5457	3	-1	1
24	5.42667	1.42667	1.4267	5	1	1
25	-0.22836	-0.22836	0.2284	0	0	0
26	0.75783	-0.24217	0.2422	1	0	0
27	0.75783	-0.24217	0.2422	1	0	0
28	0.75783	-0.24217	0.2422	1	0	0
29	0.75783	-0.24217	0.2422	1	0	0
30	1.74402	-0.25598	0.2560	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	30.159	2	1.0	0.73077	0	1	35	40.3846	2
32	26.726	2	1.0	0.73077	0	1	41	40.3846	2
33	16.833	1	0.5	0.66667	1	0	47	52.8333	3
34	0.000	1	0.5	0.66667	1	0	54	52.8333	3
35	18.856	1	0.5	0.69231	1	0	58	62.3846	4
36	13.363	1	0.5	0.69231	1	0	60	62.3846	4
37	9.124	1	0.5	0.69231	1	0	68	62.3846	4
38	14.243	2	1.0	0.66667	0	1	70	52.8333	3
39	8.571	1	0.5	0.69231	1	0	78	62.3846	4
40	61.721	1	0.5	0.60714	1	0	23	23.1429	1
41	0.000	1	0.5	0.60714	1	0	28	23.1429	1
42	0.000	1	0.5	0.60714	1	0	34	23.1429	1
43	35.635	1	0.5	0.60714	1	0	38	23.1429	1
44	0.000	1	0.5	0.73077	1	0	44	40.3846	2
45	31.849	2	1.0	0.73077	0	1	49	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	3	2.53846	2.25957	0.2596	0.27889	0.74043	1	1
32	3	2.53846	2.25957	0.2596	0.27889	0.74043	1	1
33	3	3.50000	3.27358	0.2736	0.22642	-0.27358	0	0
34	3	3.50000	3.27358	0.2736	0.22642	-0.27358	0	0
35	5	4.38462	4.28758	0.2876	0.09703	0.71242	1	1
36	5	4.38462	4.28758	0.2876	0.09703	0.71242	1	1
37	4	4.38462	4.28758	0.2876	0.09703	-0.28758	0	0
38	4	3.50000	3.27358	0.2736	0.22642	0.72642	1	1
39	4	4.38462	4.28758	0.2876	0.09703	-0.28758	0	0
40	0	1.28571	0.97980	-0.0202	0.30591	-0.97980	-1	1
41	1	1.28571	0.97980	-0.0202	0.30591	0.02020	0	0
42	1	1.28571	0.97980	-0.0202	0.30591	0.02020	0	0
43	2	1.28571	0.97980	-0.0202	0.30591	1.02020	1	1
44	2	2.53846	1.99380	-0.0062	0.54466	0.00620	0	0
45	2	2.53846	1.99380	-0.0062	0.54466	0.00620	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	2.73020	0.73020	0.7302	3	1	1
32	2.73020	0.73020	0.7302	3	1	1
33	2.73020	-0.26980	0.2698	3	0	0
34	2.73020	-0.26980	0.2698	3	0	0
35	4.70258	0.70258	0.7026	5	1	1
36	4.70258	0.70258	0.7026	5	1	1
37	3.71639	-0.28361	0.2836	4	0	0
38	3.71639	0.71639	0.7164	4	1	1
39	3.71639	-0.28361	0.2836	4	0	0
40	0.03373	-0.96627	0.9663	0	-1	1
41	1.01992	0.01992	0.0199	1	0	0

42	1.01992	0.01992	0.0199	1	0	0
43	2.00611	1.00611	1.0061	2	1	1
44	2.00611	0.00611	0.0061	2	0	0
45	2.00611	0.00611	0.0061	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
46	0.000	2	1.0	0.73077	0	1	53	40.3846	2
47	21.381	1	0.5	0.73077	1	0	59	40.3846	2
48	14.277	1	0.5	0.69231	1	0	62	62.3846	4
49	12.344	2	1.0	0.69231	0	1	67	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
46	2	2.53846	1.99380	-0.0062	0.54466	0.00620	0	0
47	2	2.53846	1.99380	-0.0062	0.54466	0.00620	0	0
48	3	4.38462	4.02182	0.0218	0.36280	-1.02182	-1	1
49	3	4.38462	4.02182	0.0218	0.36280	-1.02182	-1	1
				21.0000	0.00000	0.00000	21	27

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
46	2.00611	0.00611	0.0061	2	0	0
47	2.00611	0.00611	0.0061	2	0	0
48	2.99230	-1.00770	1.0077	3	-1	1
49	2.99230	-1.00770	1.0077	3	-1	1
		0.00000	24.8782		-3	21

A G E R E A D I N G

Date - Time : 28SEP96 - 12:07:26
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD24.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD24WAL.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD24WAL.DP

Reader : 'READER 8 '
Number data records : 49

Dependent Variable : read

Independ. Variable/s: true (1)
Options (PROC REG) : noint
Size Def. : length > 38

Regression and Tests 2

Model: M1
NOTE: No intercept in model. R-square is redefined.
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	342.85714	342.85714	859.701	0.0001
Error	48	19.14286	0.39881		
U Total	49	362.00000			

Root MSE	0.63151	R-square	0.9471
Dep Mean	2.40816	Adj R-sq	0.9460
C.V.	26.22387		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
TRUE	1	0.952381	0.03248156	29.321	0.0001

Regression and Tests 3

Dependent Variable: READ

Test: T_TRUE	Numerator:	0.8571	DF:	1	F value:	2.1493
	Denominator:	0.39881	DF:	48	Prob>F:	0.1492

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
0	0.00000	0.50000	9.0000	.	1
1	1.07143	0.60714	23.1429	44.2989	14
2	2.23077	0.50000	40.3846	32.5005	13
3	3.00000	0.58333	52.8333	21.0819	6
4	3.61538	0.61538	62.3846	17.9910	13
5	4.50000	0.50000	70.5000	15.7135	2

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.000	1	0.5	0.60714	1	0	10	23.1429	1
2	31.427	2	1.0	0.60714	0	1	21	23.1429	1
3	26.726	1	0.5	0.50000	1	0	33	40.3846	2
4	20.574	1	0.5	0.50000	1	0	38	40.3846	2
5	20.574	1	0.5	0.50000	1	0	44	40.3846	2
6	14.277	1	0.5	0.61538	1	0	52	62.3846	4
7	11.314	1	0.5	0.58333	1	0	58	52.8333	3
8	16.798	1	0.5	0.50000	1	0	64	70.5000	5
9	11.830	1	0.5	0.61538	1	0	73	62.3846	4
10	16.833	1	0.5	0.50000	1	0	77	70.5000	5
11	37.033	1	0.5	0.60714	1	0	18	23.1429	1
12	16.638	1	0.5	0.50000	1	0	28	40.3846	2
13	20.574	1	0.5	0.50000	1	0	34	40.3846	2
14	14.243	1	0.5	0.58333	1	0	49	52.8333	3
15	20.940	1	0.5	0.61538	1	0	68	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.07143	0.95238	-0.04762	0.11905	0.04762	0	0
2	2	1.07143	0.95238	-0.04762	0.11905	1.04762	1	1
3	3	2.23077	1.90476	-0.09524	0.32601	1.09524	1	1
4	3	2.23077	1.90476	-0.09524	0.32601	1.09524	1	1
5	3	2.23077	1.90476	-0.09524	0.32601	1.09524	1	1
6	3	3.61538	3.80952	-0.19048	-0.19414	-0.80952	-1	1
7	3	3.00000	2.85714	-0.14286	0.14286	0.14286	0	0
8	4	4.50000	4.76190	-0.23810	-0.26190	-0.76190	-1	1
9	4	3.61538	3.80952	-0.19048	-0.19414	0.19048	0	0
10	5	4.50000	4.76190	-0.23810	-0.26190	0.23810	0	0
11	1	1.07143	0.95238	-0.04762	0.11905	0.04762	0	0
12	2	2.23077	1.90476	-0.09524	0.32601	0.09524	0	0
13	3	2.23077	1.90476	-0.09524	0.32601	1.09524	1	1
14	3	3.00000	2.85714	-0.14286	0.14286	0.14286	0	0
15	5	3.61538	3.80952	-0.19048	-0.19414	1.19048	1	1

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	1.05	0.05	0.05	1	0	0
2	2.10	1.10	1.10	2	1	1
3	3.15	1.15	1.15	3	1	1
4	3.15	1.15	1.15	3	1	1
5	3.15	1.15	1.15	3	1	1
6	3.15	-0.85	0.85	3	-1	1
7	3.15	0.15	0.15	3	0	0
8	4.20	-0.80	0.80	4	-1	1
9	4.20	0.20	0.20	4	0	0
10	5.25	0.25	0.25	5	0	0
11	1.05	0.05	0.05	1	0	0
12	2.10	0.10	0.10	2	0	0
13	3.15	1.15	1.15	3	1	1
14	3.15	0.15	0.15	3	0	0
15	5.25	1.25	1.25	5	1	1

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	12.344	1	0.5	0.61538	1	0	80	62.3846	4
17	37.033	1	0.5	0.60714	1	0	19	23.1429	1
18	37.033	1	0.5	0.60714	1	0	22	23.1429	1
19	31.427	2	1.0	0.60714	0	1	28	23.1429	1
20	16.638	1	0.5	0.50000	1	0	33	40.3846	2
21	25.713	1	0.5	0.58333	1	0	39	52.8333	3
22	18.898	2	1.0	0.61538	0	1	44	62.3846	4
23	14.277	1	0.5	0.61538	1	0	49	62.3846	4
24	20.940	2	1.0	0.61538	0	1	52	62.3846	4
25	282.843	1	0.5	0.50000	1	0	9	9.0000	0
26	82.808	2	1.0	0.60714	0	1	13	23.1429	1
27	31.427	1	0.5	0.60714	1	0	18	23.1429	1
28	0.000	1	0.5	0.60714	1	0	24	23.1429	1
29	0.000	1	0.5	0.60714	1	0	28	23.1429	1
30	18.856	1	0.5	0.50000	1	0	34	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	4	3.61538	3.80952	-0.19048	-0.19414	0.19048	0	0
17	1	1.07143	0.95238	-0.04762	0.11905	0.04762	0	0
18	1	1.07143	0.95238	-0.04762	0.11905	0.04762	0	0
19	1	1.07143	0.95238	-0.04762	0.11905	0.04762	0	0
20	2	2.23077	1.90476	-0.09524	0.32601	0.09524	0	0
21	2	3.00000	2.85714	-0.14286	0.14286	-0.85714	-1	1
22	3	3.61538	3.80952	-0.19048	-0.19414	-0.80952	-1	1
23	3	3.61538	3.80952	-0.19048	-0.19414	-0.80952	-1	1
24	4	3.61538	3.80952	-0.19048	-0.19414	0.19048	0	0
25	0	0.00000	0.00000	0.00000	0.00000	0.00000	0	0
26	0	1.07143	0.95238	-0.04762	0.11905	-0.95238	-1	1
27	1	1.07143	0.95238	-0.04762	0.11905	0.04762	0	0
28	1	1.07143	0.95238	-0.04762	0.11905	0.04762	0	0
29	1	1.07143	0.95238	-0.04762	0.11905	0.04762	0	0
30	1	2.23077	1.90476	-0.09524	0.32601	-0.90476	-1	1

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	4.20	0.20	0.20	4	0	0
17	1.05	0.05	0.05	1	0	0
18	1.05	0.05	0.05	1	0	0
19	1.05	0.05	0.05	1	0	0
20	2.10	0.10	0.10	2	0	0
21	2.10	-0.90	0.90	2	-1	1
22	3.15	-0.85	0.85	3	-1	1
23	3.15	-0.85	0.85	3	-1	1
24	4.20	0.20	0.20	4	0	0
25	0.00	0.00	0.00	0	0	0
26	0.00	-1.00	1.00	0	-1	1

27	1.05	0.05	0.05	1	0	0
28	1.05	0.05	0.05	1	0	0
29	1.05	0.05	0.05	1	0	0
30	1.05	-0.95	0.95	1	-1	1

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	30.159	1	0.5	0.50000	1	0	35	40.3846	2
32	26.726	1	0.5	0.50000	1	0	41	40.3846	2
33	16.833	1	0.5	0.58333	1	0	47	52.8333	3
34	0.000	1	0.5	0.58333	1	0	54	52.8333	3
35	18.856	2	1.0	0.61538	0	1	58	62.3846	4
36	13.363	1	0.5	0.61538	1	0	60	62.3846	4
37	9.124	1	0.5	0.61538	1	0	68	62.3846	4
38	14.243	2	1.0	0.58333	0	1	70	52.8333	3
39	8.571	1	0.5	0.61538	1	0	78	62.3846	4
40	61.721	1	0.5	0.60714	1	0	23	23.1429	1
41	0.000	1	0.5	0.60714	1	0	28	23.1429	1
42	0.000	1	0.5	0.60714	1	0	34	23.1429	1
43	35.635	1	0.5	0.60714	1	0	38	23.1429	1
44	0.000	1	0.5	0.50000	1	0	44	40.3846	2
45	31.849	1	0.5	0.50000	1	0	49	40.3846	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.23077	1.90476	-0.09524	0.32601	0.09524	0	0
32	2	2.23077	1.90476	-0.09524	0.32601	0.09524	0	0
33	3	3.00000	2.85714	-0.14286	0.14286	0.14286	0	0
34	3	3.00000	2.85714	-0.14286	0.14286	0.14286	0	0
35	3	3.61538	3.80952	-0.19048	-0.19414	-0.80952	-1	1
36	4	3.61538	3.80952	-0.19048	-0.19414	0.19048	0	0
37	4	3.61538	3.80952	-0.19048	-0.19414	0.19048	0	0
38	4	3.00000	2.85714	-0.14286	0.14286	1.14286	1	1
39	4	3.61538	3.80952	-0.19048	-0.19414	0.19048	0	0
40	1	1.07143	0.95238	-0.04762	0.11905	0.04762	0	0
41	1	1.07143	0.95238	-0.04762	0.11905	0.04762	0	0
42	1	1.07143	0.95238	-0.04762	0.11905	0.04762	0	0
43	2	1.07143	0.95238	-0.04762	0.11905	1.04762	1	1
44	2	2.23077	1.90476	-0.09524	0.32601	0.09524	0	0
45	1	2.23077	1.90476	-0.09524	0.32601	-0.90476	-1	1

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	2.10	0.10	0.10	2	0	0
32	2.10	0.10	0.10	2	0	0
33	3.15	0.15	0.15	3	0	0
34	3.15	0.15	0.15	3	0	0
35	3.15	-0.85	0.85	3	-1	1
36	4.20	0.20	0.20	4	0	0
37	4.20	0.20	0.20	4	0	0

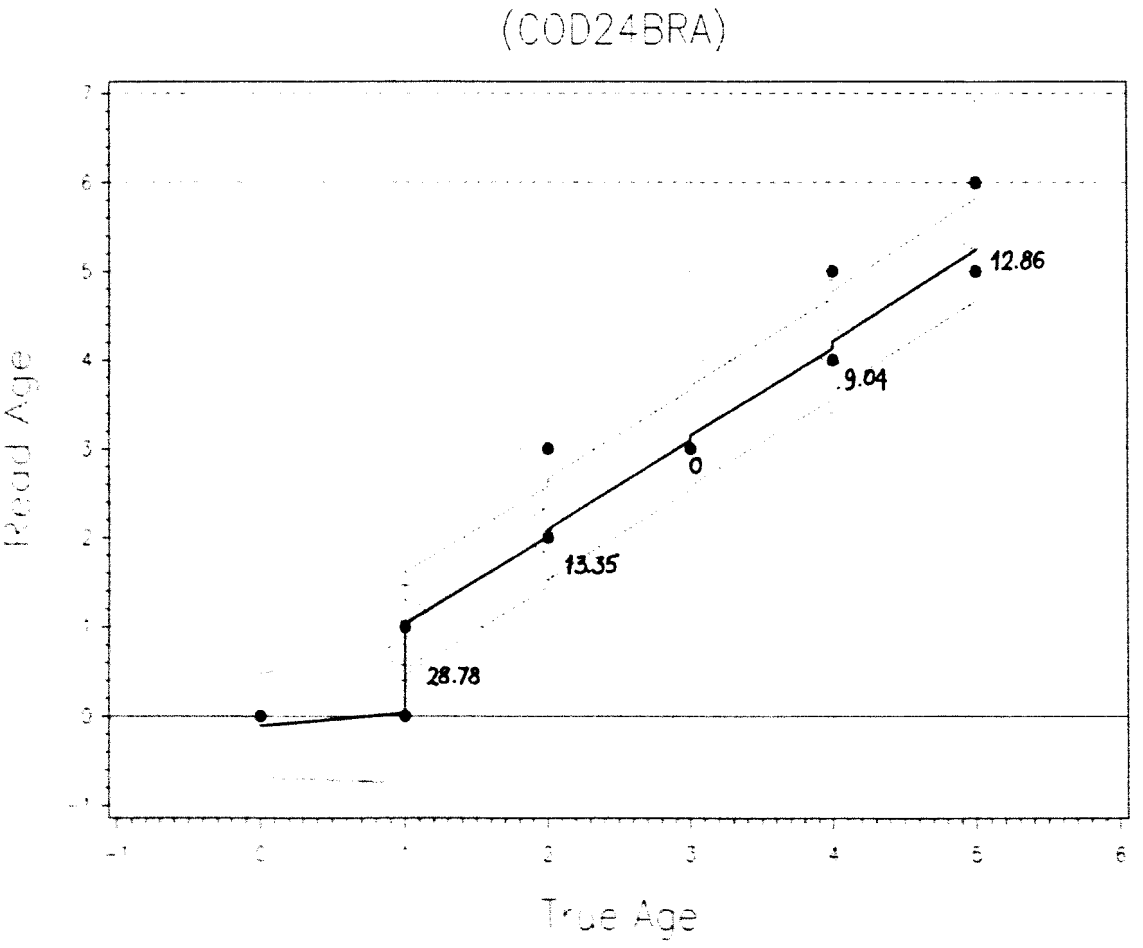
38	4.20	1.20	1.20	4	1	1
39	4.20	0.20	0.20	4	0	0
40	1.05	0.05	0.05	1	0	0
41	1.05	0.05	0.05	1	0	0
42	1.05	0.05	0.05	1	0	0
43	2.10	1.10	1.10	2	1	1
44	2.10	0.10	0.10	2	0	0
45	1.05	-0.95	0.95	1	-1	1

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
46	0.000	1	0.5	0.50000	1	0	53	40.3846	2
47	21.381	1	0.5	0.50000	1	0	59	40.3846	2
48	14.277	1	0.5	0.61538	1	0	62	62.3846	4
49	12.344	1	0.5	0.61538	1	0	67	62.3846	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
46	2	2.23077	1.90476	-0.09524	0.32601	0.09524	0	0
47	3	2.23077	1.90476	-0.09524	0.32601	1.09524	1	1
48	3	3.61538	3.80952	-0.19048	-0.19414	-0.80952	-1	1
49	3	3.61538	3.80952	-0.19048	-0.19414	-0.80952	-1	1
				-5.71429	3.71429	3.71429	-2	20

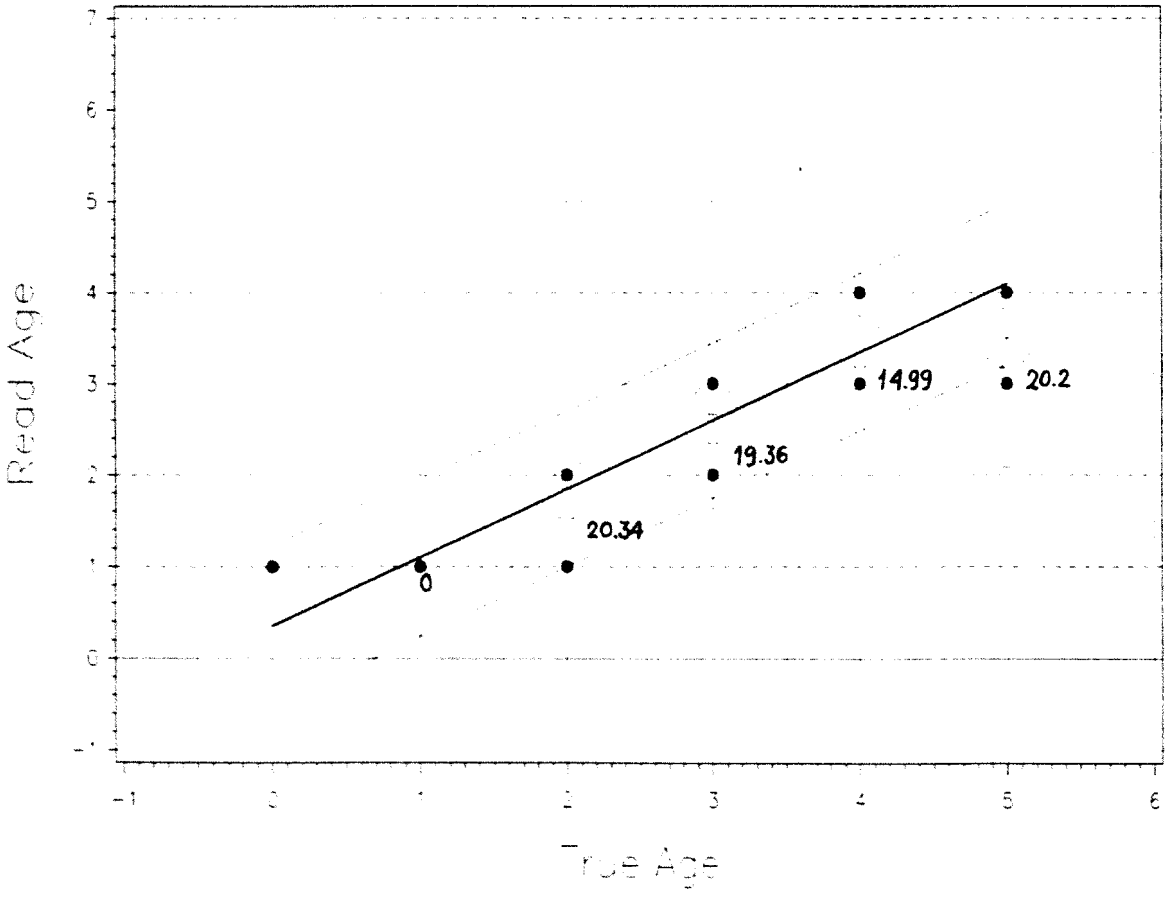
Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
46	2.10	0.10	0.10	2	0	0
47	3.15	1.15	1.15	3	1	1
48	3.15	-0.85	0.85	3	-1	1
49	3.15	-0.85	0.85	3	-1	1
		3.90	23.30		-2	20

MODEL: read = f (true rda rda_good rectangl) /... noint



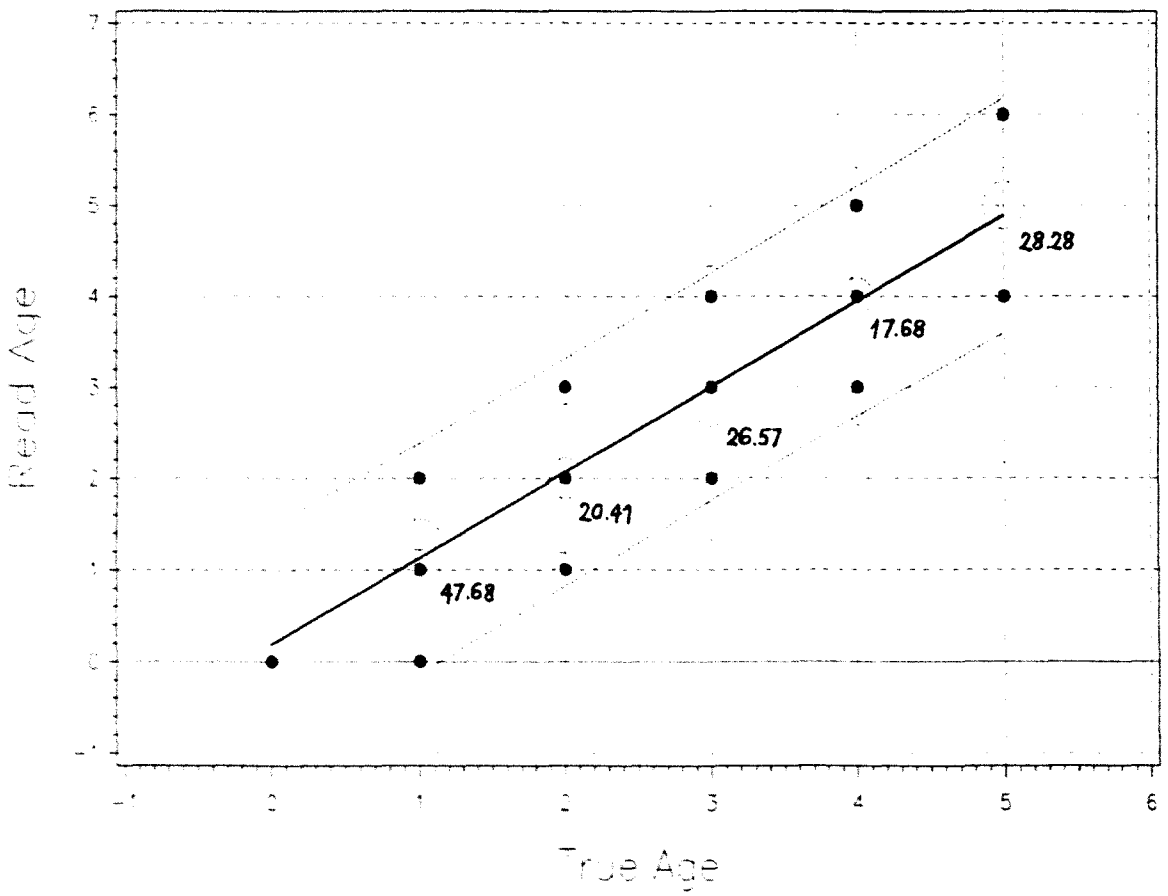
MODEL: read = f (true) /...

(COD24BRO)



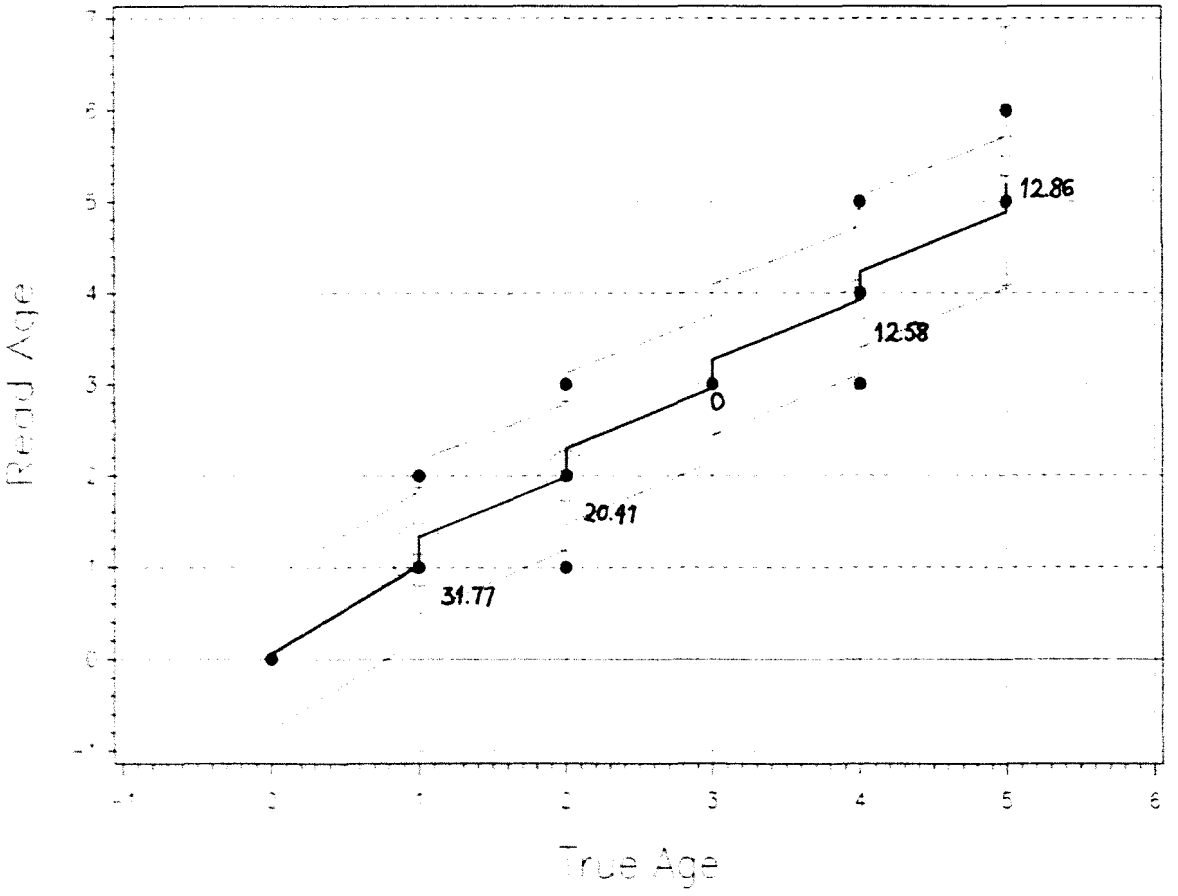
MODEL: read = f (true) /...

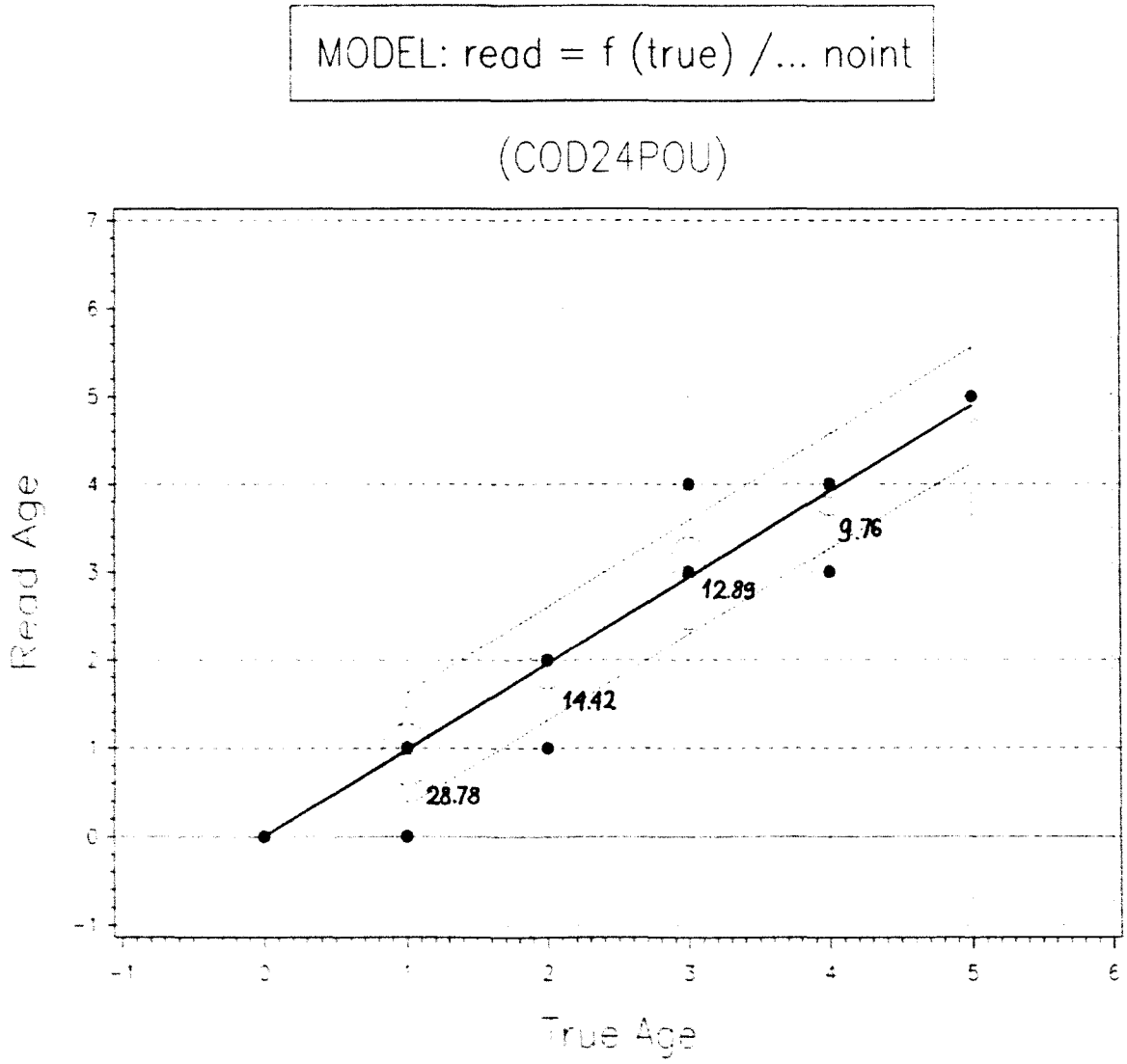
(COD24HOF)



MODEL: read = f (true rda) /...

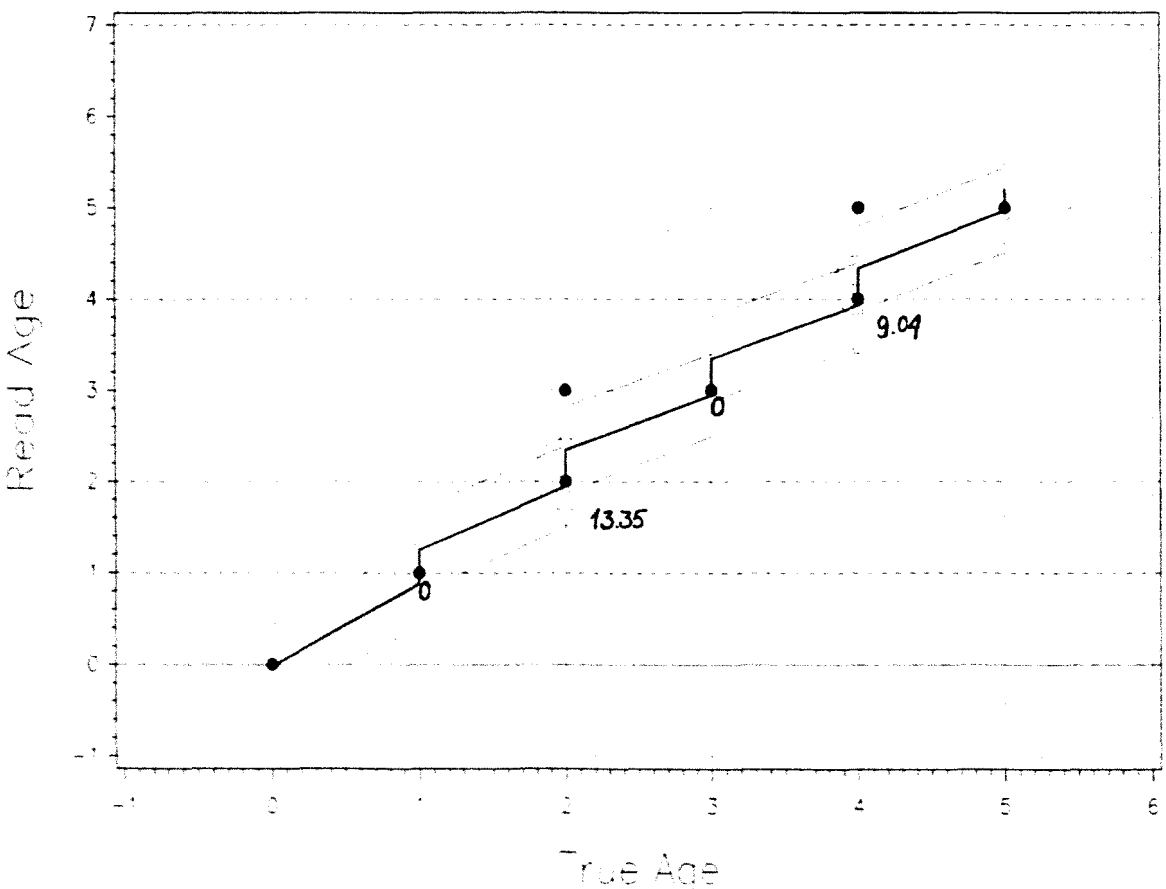
(COD24LUN)




MODEL: read = f (true) /... noint
(COD24POU)
Read Age
True Age
28.78
14.42
12.89
9.76

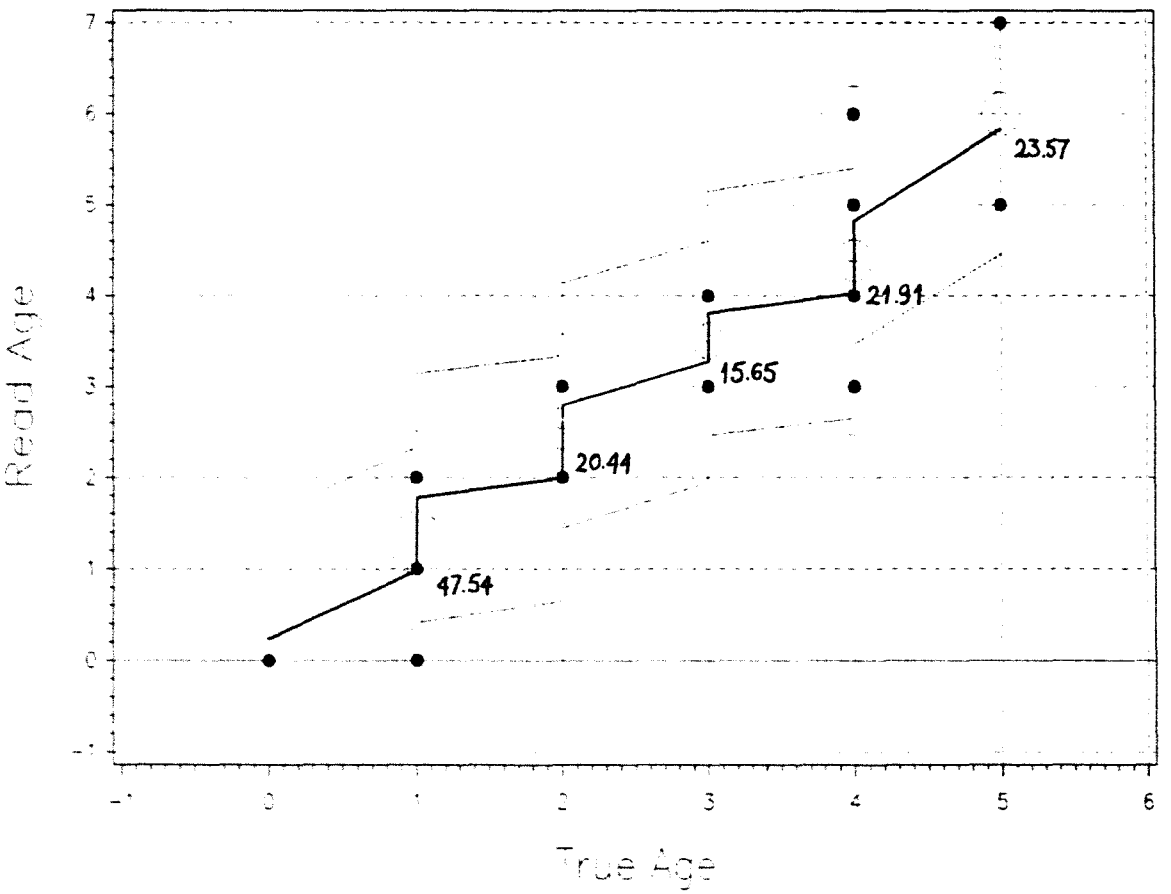
MODEL: read = f (true rda_good length) /... noint

(COD24SJO)



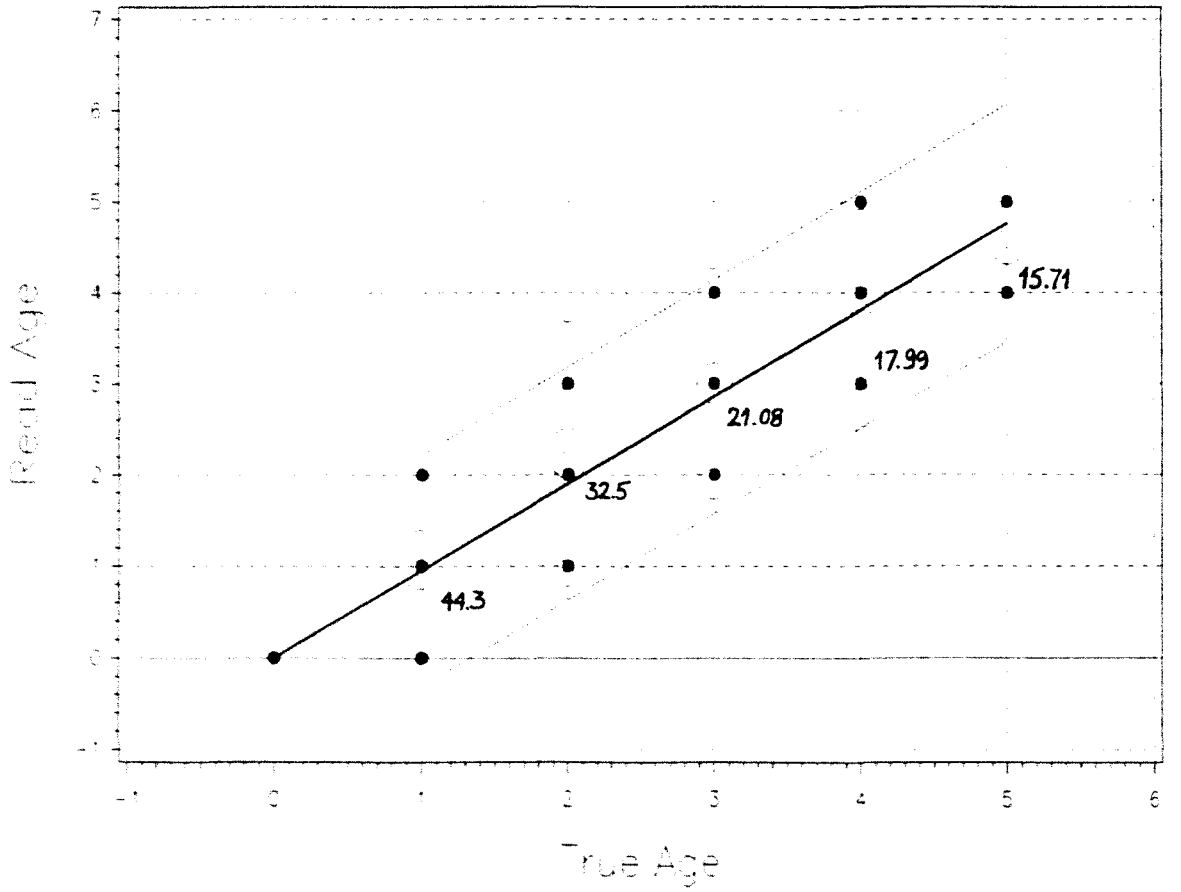
MODEL: read = f (true quarter) /...

(COD24ULR)



MODEL: read = f (true) /... noint

(COD24WAL)



. SD 26

A G E R E A D I N G

Date - Time : 08OCT96 - 18:50:49
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD26.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\STAT26_1.OUT

Number data records : 114
Approx. of True Age : Median
Width of CV category: 10

2

CVGROUP=1

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
1	10	1	1	1	1.0000	1	0.00000
2	10	3	2	2	2.0000	2	0.00000
3	10	4	2	2	2.0000	2	0.00000
4	10	6	4	4	4.0000	4	0.00000
5	10	9	4	4	4.0000	4	0.00000
6	10	10	6	6	6.0000	6	0.00000
7	10	12	2	2	2.0000	2	0.00000
8	10	14	3	3	3.0000	3	0.00000
9	10	17	4	4	4.0000	4	0.00000
10	10	18	2	2	2.0000	2	0.00000
11	10	20	3	3	3.0000	3	0.00000
12	10	25	7	7	7.0000	7	0.00000
13	10	26	6	6	6.0000	6	0.00000
14	10	29	1	1	1.0000	1	0.00000
15	10	30	2	2	2.0000	2	0.00000
16	10	31	2	2	2.0000	2	0.00000
17	10	32	3	3	3.0000	3	0.00000
18	10	36	4	4	4.0000	4	0.00000
19	10	28	11	11	10.6667	11	5.41266
20	10	27	8	8	7.6667	8	7.53066

CVGROUP=2

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
21	20	37	6	6	5.66667	6	10.1885
22	20	24	5	5	5.33333	5	10.8253
23	20	11	8	9	9.00000	9	11.1111
24	20	7	5	5	4.66667	5	12.3718
25	20	8	5	5	4.66667	5	12.3718
26	20	34	4	4	3.66667	4	15.7459

27	20	5	3	3	3.33333	3	17.3205
28	20	19	3	3	3.33333	3	17.3205
29	20	21	3	3	3.33333	3	17.3205
30	20	38	7	9	8.66667	9	17.6253

---------- CVGROUP=3 ----------

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
31	30	2	3	3	2.66667	3	21.6506
32	30	22	4	4	4.66667	5	24.7436
33	30	33	2	2	2.33333	2	24.7436
34	30	13	3	4	4.00000	4	25.0000
35	30	16	4	6	5.66667	6	26.9563
36	30	35	7	7	6.00000	6	28.8675

---------- CVGROUP=4 ----------

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
37	40	23	3	3	3.66667	4	31.4918
38	40	15	3	5	4.66667	5	32.7327

3

General Linear Models Procedure
Class Level Information

Class	Levels	Values
NATION	3	LV POL SW
TRUE	10	1 2 3 4 5 6 7 8 9 11

Number of observations in data set = 114

4

General Linear Models Procedure

Dependent Variable: AGE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	552.08646617	50.18967874	144.06	0.0001
Error	102	35.53634085	0.34839550		
Corrected Total	113	587.62280702			

R-Square	C.V.	Root MSE	AGE Mean
0.939525	13.87393	0.5902504	4.2543860

Source	DF	Type I SS	Mean Square	F Value	Pr > F
NATION	2	8.70175439	4.35087719	12.49	0.0001
TRUE	9	543.38471178	60.37607909	173.30	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
NATION	2	8.70175439	4.35087719	12.49	0.0001
TRUE	9	543.38471178	60.37607909	173.30	0.0001

5

General Linear Models Procedure

Bonferroni (Dunn) T tests for variable: AGE

NOTE: This test controls the type I experimentwise error rate, but generally has a higher type II error rate than REGWQ.

Alpha= 0.05 df= 102 MSE= 0.348395
Critical Value of T= 2.43
Minimum Significant Difference= 0.3296

Means with the same letter are not significantly different.

Bon Grouping	Mean	N	NATION
A	4.5000	38	LV
A			
A	4.3947	38	POL
B	3.8684	38	SW

A G E R E A D I N G

Date - Time : 08OCT96 - 20:32:41
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD26.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD26BAR.OU1
Data Graphic Files : D:\SASOUT\IOR\AGINGW~1\COD26BAR.DP1/2

Reader : 'READER 1 '
Number data records : 38

Dependent Variable : read
Independ. Variable/s: true size (2)

Approx. of True Age : Median
Size Def. : length > 38
Options (PROC REG) : noint

Regression and Tests 2

Model: M1
NOTE: No intercept in model. R-square is redefined.
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	973.49047	486.74523	1842.659	0.0001
Error	36	9.50953	0.26415		
U Total	38	983.00000			

Root MSE	0.51396	R-square	0.9903
Dep Mean	4.50000	Adj R-sq	0.9898
C.V.	11.42131		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
TRUE	1	0.967426	0.03699899	26.147	0.0001
SIZE	1	0.449750	0.21011386	2.141	0.0392

Regression and Tests 3

Dependent Variable: READ

Test: T_TRUE	Numerator:	0.2048	DF:	1	F value:	0.7751
	Denominator:	0.264154	DF:	36	Prob>F:	0.3845

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1.0000	0.5000	16.5000	0.0000	2
2	2.0000	0.5000	34.4286	0.0000	7
3	3.5000	0.5625	42.5000	21.5980	8
4	4.2857	0.5000	52.0000	17.6383	7
5	5.2500	0.6250	54.2500	9.5238	4
6	6.0000	0.5000	72.7500	0.0000	4
7	7.0000	0.5000	67.0000	0.0000	2
8	8.0000	0.5000	88.0000	.	1
9	9.5000	0.5000	90.0000	7.4432	2
11	11.0000	0.5000	95.0000	.	1

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.0000	1	0.5	0.5000	1	0	11	16.5000	1
2	21.6506	1	0.5	0.5625	1	0	27	42.5000	3
3	0.0000	1	0.5	0.5000	1	0	27	34.4286	2
4	0.0000	1	0.5	0.5000	1	0	30	34.4286	2
5	17.3205	1	0.5	0.5625	1	0	38	42.5000	3
6	0.0000	1	0.5	0.5000	1	0	42	52.0000	4
7	12.3718	2	1.0	0.6250	0	1	48	54.2500	5
8	12.3718	1	0.5	0.6250	1	0	53	54.2500	5
9	0.0000	1	0.5	0.5000	1	0	57	52.0000	4
10	0.0000	1	0.5	0.5000	1	0	72	72.7500	6
11	11.1111	1	0.5	0.5000	1	0	92	90.0000	9
12	0.0000	1	0.5	0.5000	1	0	27	34.4286	2
13	25.0000	1	0.5	0.5000	1	0	37	52.0000	4
14	0.0000	1	0.5	0.5625	1	0	43	42.5000	3
15	32.7327	1	0.5	0.6250	1	0	49	54.2500	5

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.0000	0.9674	-0.03257	0.03257	0.03257	0	0
2	3	3.5000	2.9023	-0.09772	0.59772	0.09772	0	0
3	2	2.0000	1.9349	-0.06515	0.06515	0.06515	0	0
4	2	2.0000	1.9349	-0.06515	0.06515	0.06515	0	0
5	3	3.5000	2.9023	-0.09772	0.59772	0.09772	0	0
6	4	4.2857	4.3195	0.31945	-0.03374	-0.31945	0	0
7	5	5.2500	5.2869	0.28688	-0.03688	-0.28688	0	0
8	5	5.2500	5.2869	0.28688	-0.03688	-0.28688	0	0
9	4	4.2857	4.3195	0.31945	-0.03374	-0.31945	0	0
10	6	6.0000	6.2543	0.25430	-0.25430	-0.25430	0	0
11	10	9.5000	9.1566	0.15658	0.34342	0.84342	1	1
12	2	2.0000	1.9349	-0.06515	0.06515	0.06515	0	0
13	4	4.2857	3.8697	-0.13030	0.41601	0.13030	0	0
14	3	3.5000	3.3520	0.35203	0.14797	-0.35203	0	0
15	6	5.2500	5.2869	0.28688	-0.03688	0.71312	1	1

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	1.0337	0.03367	0.0337	1	0	0
2	3.1010	0.10101	0.1010	3	0	0
3	2.0673	0.06734	0.0673	2	0	0
4	2.0673	0.06734	0.0673	2	0	0
5	3.1010	0.10101	0.1010	3	0	0
6	3.6698	-0.33021	0.3302	4	0	0
7	4.7035	-0.29654	0.2965	5	0	0
8	4.7035	-0.29654	0.2965	5	0	0
9	3.6698	-0.33021	0.3302	4	0	0
10	5.7371	-0.26287	0.2629	6	0	0
11	9.8718	0.87182	0.8718	10	1	1
12	2.0673	0.06734	0.0673	2	0	0
13	4.1347	0.13469	0.1347	4	0	0

14	2.6361	-0.36388	0.3639	3	0	0
15	5.7371	0.73713	0.7371	6	1	1

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Average Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	26.9563	1	0.5	0.5000	1	0	65	72.7500	6
17	0.0000	1	0.5	0.5000	1	0	67	52.0000	4
18	0.0000	1	0.5	0.5000	1	0	29	34.4286	2
19	17.3205	1	0.5	0.5625	1	0	42	42.5000	3
20	0.0000	1	0.5	0.5625	1	0	43	42.5000	3
21	17.3205	1	0.5	0.5625	1	0	46	42.5000	3
22	24.7436	1	0.5	0.5000	1	0	50	52.0000	4
23	31.4918	1	0.5	0.5625	1	0	58	42.5000	3
24	10.8253	1	0.5	0.6250	1	0	67	54.2500	5
25	0.0000	1	0.5	0.5000	1	0	76	67.0000	7
26	0.0000	1	0.5	0.5000	1	0	81	72.7500	6
27	7.5307	1	0.5	0.5000	1	0	88	88.0000	8
28	5.4127	1	0.5	0.5000	1	0	95	95.0000	11
29	0.0000	1	0.5	0.5000	1	0	22	16.5000	1
30	0.0000	1	0.5	0.5000	1	0	38	34.4286	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Read Age - Residuals	Read Age - True Age	|Read Age - True Age|
16	6	6.0000	6.2543	0.25430	-0.25430	-0.25430	0	0
17	4	4.2857	4.3195	0.31945	-0.03374	-0.31945	0	0
18	2	2.0000	1.9349	-0.06515	0.06515	0.06515	0	0
19	4	3.5000	3.3520	0.35203	0.14797	0.64797	1	1
20	3	3.5000	3.3520	0.35203	0.14797	-0.35203	0	0
21	4	3.5000	3.3520	0.35203	0.14797	0.64797	1	1
22	6	4.2857	4.3195	0.31945	-0.03374	1.68055	2	2
23	5	3.5000	3.3520	0.35203	0.14797	1.64797	2	2
24	5	5.2500	5.2869	0.28688	-0.03688	-0.28688	0	0
25	7	7.0000	7.2217	0.22173	-0.22173	-0.22173	0	0
26	6	6.0000	6.2543	0.25430	-0.25430	-0.25430	0	0
27	8	8.0000	8.1892	0.18915	-0.18915	-0.18915	0	0
28	11	11.0000	11.0914	0.09143	-0.09143	-0.09143	0	0
29	1	1.0000	0.9674	-0.03257	0.03257	0.03257	0	0
30	2	2.0000	1.9349	-0.06515	0.06515	0.06515	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	5.7371	-0.26287	0.2629	6	0	0
17	3.6698	-0.33021	0.3302	4	0	0
18	2.0673	0.06734	0.0673	2	0	0
19	3.6698	0.66979	0.6698	4	1	1
20	2.6361	-0.36388	0.3639	3	0	0
21	3.6698	0.66979	0.6698	4	1	1
22	5.7371	1.73713	1.7371	6	2	2
23	4.7035	1.70346	1.7035	5	2	2
24	4.7035	-0.29654	0.2965	5	0	0
25	6.7708	-0.22919	0.2292	7	0	0

26	5.7371	-0.26287	0.2629	6	0	0
27	7.8045	-0.19552	0.1955	8	0	0
28	10.9055	-0.09451	0.0945	11	0	0
29	1.0337	0.03367	0.0337	1	0	0
30	2.0673	0.06734	0.0673	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	0.0000	1	0.5	0.5000	1	0	42	34.4286	2
32	0.0000	2	1.0	0.5625	0	1	43	42.5000	3
33	24.7436	1	0.5	0.5000	1	0	48	34.4286	2
34	15.7459	1	0.5	0.5000	1	0	49	52.0000	4
35	28.8675	1	0.5	0.5000	1	0	58	67.0000	7
36	0.0000	1	0.5	0.5000	1	0	62	52.0000	4
37	10.1885	1	0.5	0.5000	1	0	73	72.7500	6
38	17.6253	1	0.5	0.5000	1	0	88	90.0000	9

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.0000	2.3846	0.38460	-0.38460	-0.38460	0	0
32	3	3.5000	3.3520	0.35203	0.14797	-0.35203	0	0
33	2	2.0000	2.3846	0.38460	-0.38460	-0.38460	0	0
34	4	4.2857	4.3195	0.31945	-0.03374	-0.31945	0	0
35	7	7.0000	7.2217	0.22173	-0.22173	-0.22173	0	0
36	4	4.2857	4.3195	0.31945	-0.03374	-0.31945	0	0
37	6	6.0000	6.2543	0.25430	-0.25430	-0.25430	0	0
38	9	9.5000	9.1566	0.15658	0.34342	-0.15658	0	0
				7.28336	0.71664	0.71664	8	8

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	1.6024	-0.39755	0.3976	2	0	0
32	2.6361	-0.36388	0.3639	3	0	0
33	1.6024	-0.39755	0.3976	2	0	0
34	3.6698	-0.33021	0.3302	4	0	0
35	6.7708	-0.22919	0.2292	7	0	0
36	3.6698	-0.33021	0.3302	4	0	0
37	5.7371	-0.26287	0.2629	6	0	0
38	8.8381	-0.16185	0.1619	9	0	0
		0.74077	13.5190		8	8

A G E R E A D I N G

```
Date - Time          : 08OCT96 - 20:36:07
Analysing Scientist  : Dr. J. Groeger, IOR, BFAFi HRO


Data Input File      : D:\DATEN\IOR\AGINGW~1\COD26.TAB
Data Output File     : D:\SASOUT\IOR\AGINGW~1\COD26NET.OU1
Data Graphic Files   : D:\SASOUT\IOR\AGINGW~1\COD26NET.DP1/2

Reader               : 'READER 2     '
Number data records  : 38

Dependent Variable   : read
Independ. Variable/s: true (1)

Approx. of True Age  : Median
Size Def.            : length > 38
Options (PROC REG)   : noint
```

Regression and Tests 2

Model: M1
NOTE: No intercept in model. R-square is redefined.
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	947.53599	947.53599	10120.884	0.0001
Error	37	3.46401	0.09362		
U Total	38	951.00000			

Root MSE	0.30598	R-square	0.9964
Dep Mean	4.39474	Adj R-sq	0.9963
C.V.	6.96235		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
TRUE	1	1.024363	0.01018227	100.603	0.0001

Regression and Tests 3

Dependent Variable: READ
Test: T_TRUE Numerator: 0.5360 DF: 1 F value: 5.7251
Denominator: 0.093622 DF: 37 Prob>F: 0.0219

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1.0000	0.75000	16.5000	0.0000	2
2	2.0000	0.57143	34.4286	0.0000	7
3	3.1250	0.56250	42.5000	11.3137	8
4	4.1429	0.50000	52.0000	9.1233	7
5	5.0000	0.62500	54.2500	0.0000	4
6	6.2500	0.50000	72.7500	8.0000	4
7	7.0000	0.50000	67.0000	0.0000	2
8	8.0000	0.50000	88.0000	.	1
9	9.5000	0.50000	90.0000	7.4432	2
11	11.0000	0.50000	95.0000	.	1

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.0000	2	1.0	0.75000	0	1	11	16.5000	1
2	21.6506	1	0.5	0.56250	1	0	27	42.5000	3
3	0.0000	1	0.5	0.57143	1	0	27	34.4286	2
4	0.0000	2	1.0	0.57143	0	1	30	34.4286	2
5	17.3205	1	0.5	0.56250	1	0	38	42.5000	3
6	0.0000	1	0.5	0.50000	1	0	42	52.0000	4
7	12.3718	2	1.0	0.62500	0	1	48	54.2500	5
8	12.3718	1	0.5	0.62500	1	0	53	54.2500	5
9	0.0000	1	0.5	0.50000	1	0	57	52.0000	4
10	0.0000	1	0.5	0.50000	1	0	72	72.7500	6
11	11.1111	1	0.5	0.50000	1	0	92	90.0000	9
12	0.0000	1	0.5	0.57143	1	0	27	34.4286	2
13	25.0000	1	0.5	0.50000	1	0	37	52.0000	4
14	0.0000	1	0.5	0.56250	1	0	43	42.5000	3
15	32.7327	1	0.5	0.62500	1	0	49	54.2500	5

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.0000	1.0244	0.02436	-0.02436	-0.02436	0	0
2	3	3.1250	3.0731	0.07309	0.05191	-0.07309	0	0
3	2	2.0000	2.0487	0.04873	-0.04873	-0.04873	0	0
4	2	2.0000	2.0487	0.04873	-0.04873	-0.04873	0	0
5	4	3.1250	3.0731	0.07309	0.05191	0.92691	1	1
6	4	4.1429	4.0975	0.09745	0.04540	-0.09745	0	0
7	5	5.0000	5.1218	0.12182	-0.12182	-0.12182	0	0
8	5	5.0000	5.1218	0.12182	-0.12182	-0.12182	0	0
9	4	4.1429	4.0975	0.09745	0.04540	-0.09745	0	0
10	6	6.2500	6.1462	0.14618	0.10382	-0.14618	0	0
11	9	9.5000	9.2193	0.21927	0.28073	-0.21927	0	0
12	2	2.0000	2.0487	0.04873	-0.04873	-0.04873	0	0
13	5	4.1429	4.0975	0.09745	0.04540	0.90255	1	1
14	3	3.1250	3.0731	0.07309	0.05191	-0.07309	0	0
15	5	5.0000	5.1218	0.12182	-0.12182	-0.12182	0	0

Estim. Age |Estim. Age

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	- True Age (rounded)	- True Age| (rounded)
1	0.9762	-0.02378	0.02378	1	0	0
2	2.9286	-0.07135	0.07135	3	0	0
3	1.9524	-0.04757	0.04757	2	0	0
4	1.9524	-0.04757	0.04757	2	0	0
5	3.9049	0.90486	0.90486	4	1	1
6	3.9049	-0.09514	0.09514	4	0	0
7	4.8811	-0.11892	0.11892	5	0	0
8	4.8811	-0.11892	0.11892	5	0	0
9	3.9049	-0.09514	0.09514	4	0	0
10	5.8573	-0.14270	0.14270	6	0	0
11	8.7859	-0.21405	0.21405	9	0	0
12	1.9524	-0.04757	0.04757	2	0	0
13	4.8811	0.88108	0.88108	5	1	1
14	2.9286	-0.07135	0.07135	3	0	0
15	4.8811	-0.11892	0.11892	5	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	26.9563	1	0.5	0.50000	1	0	65	72.7500	6
17	0.0000	1	0.5	0.50000	1	0	67	52.0000	4
18	0.0000	1	0.5	0.57143	1	0	29	34.4286	2
19	17.3205	1	0.5	0.56250	1	0	42	42.5000	3
20	0.0000	1	0.5	0.56250	1	0	43	42.5000	3
21	17.3205	1	0.5	0.56250	1	0	46	42.5000	3
22	24.7436	1	0.5	0.50000	1	0	50	52.0000	4
23	31.4918	2	1.0	0.56250	0	1	58	42.5000	3
24	10.8253	1	0.5	0.62500	1	0	67	54.2500	5
25	0.0000	1	0.5	0.50000	1	0	76	67.0000	7
26	0.0000	1	0.5	0.50000	1	0	81	72.7500	6
27	7.5307	1	0.5	0.50000	1	0	88	88.0000	8
28	5.4127	1	0.5	0.50000	1	0	95	95.0000	11
29	0.0000	1	0.5	0.75000	1	0	22	16.5000	1
30	0.0000	1	0.5	0.57143	1	0	38	34.4286	2

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	7	6.2500	6.1462	0.14618	0.10382	0.85382	1	1
17	4	4.1429	4.0975	0.09745	0.04540	-0.09745	0	0
18	2	2.0000	2.0487	0.04873	-0.04873	-0.04873	0	0
19	3	3.1250	3.0731	0.07309	0.05191	-0.07309	0	0
20	3	3.1250	3.0731	0.07309	0.05191	-0.07309	0	0
21	3	3.1250	3.0731	0.07309	0.05191	-0.07309	0	0
22	4	4.1429	4.0975	0.09745	0.04540	-0.09745	0	0
23	3	3.1250	3.0731	0.07309	0.05191	-0.07309	0	0
24	5	5.0000	5.1218	0.12182	-0.12182	-0.12182	0	0
25	7	7.0000	7.1705	0.17054	-0.17054	-0.17054	0	0
26	6	6.2500	6.1462	0.14618	0.10382	-0.14618	0	0
27	8	8.0000	8.1949	0.19491	-0.19491	-0.19491	0	0
28	11	11.0000	11.2680	0.26800	-0.26800	-0.26800	0	0

29	1	1.0000	1.0244	0.02436	-0.02436	-0.02436	0	0
30	2	2.0000	2.0487	0.04873	-0.04873	-0.04873	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	6.8335	0.83351	0.83351	7	1	1
17	3.9049	-0.09514	0.09514	4	0	0
18	1.9524	-0.04757	0.04757	2	0	0
19	2.9286	-0.07135	0.07135	3	0	0
20	2.9286	-0.07135	0.07135	3	0	0
21	2.9286	-0.07135	0.07135	3	0	0
22	3.9049	-0.09514	0.09514	4	0	0
23	2.9286	-0.07135	0.07135	3	0	0
24	4.8811	-0.11892	0.11892	5	0	0
25	6.8335	-0.16649	0.16649	7	0	0
26	5.8573	-0.14270	0.14270	6	0	0
27	7.8097	-0.19027	0.19027	8	0	0
28	10.7384	-0.26162	0.26162	11	0	0
29	0.9762	-0.02378	0.02378	1	0	0
30	1.9524	-0.04757	0.04757	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	0.0000	1	0.5	0.57143	1	0	42	34.4286	2
32	0.0000	1	0.5	0.56250	1	0	43	42.5000	3
33	24.7436	1	0.5	0.57143	1	0	48	34.4286	2
34	15.7459	1	0.5	0.50000	1	0	49	52.0000	4
35	28.8675	1	0.5	0.50000	1	0	58	67.0000	7
36	0.0000	1	0.5	0.50000	1	0	62	52.0000	4
37	10.1885	1	0.5	0.50000	1	0	73	72.7500	6
38	17.6253	1	0.5	0.50000	1	0	88	90.0000	9

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.0000	2.0487	0.04873	-0.04873	-0.04873	0	0
32	3	3.1250	3.0731	0.07309	0.05191	-0.07309	0	0
33	2	2.0000	2.0487	0.04873	-0.04873	-0.04873	0	0
34	4	4.1429	4.0975	0.09745	0.04540	-0.09745	0	0
35	7	7.0000	7.1705	0.17054	-0.17054	-0.17054	0	0
36	4	4.1429	4.0975	0.09745	0.04540	-0.09745	0	0
37	6	6.2500	6.1462	0.14618	0.10382	-0.14618	0	0
38	10	9.5000	9.2193	0.21927	0.28073	0.78073	1	1
				3.97121	0.02879	0.02879	4	4

Otol.	Estim.	Estim. Age -	|Estim. Age -	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|

No.	Age	True Age	True Age|	(rounded)	(rounded)	(rounded)
31	1.9524	-0.04757	0.04757	2	0	0
32	2.9286	-0.07135	0.07135	3	0	0
33	1.9524	-0.04757	0.04757	2	0	0
34	3.9049	-0.09514	0.09514	4	0	0
35	6.8335	-0.16649	0.16649	7	0	0
36	3.9049	-0.09514	0.09514	4	0	0
37	5.8573	-0.14270	0.14270	6	0	0
38	9.7622	0.76216	0.76216	10	1	1
		0.02811	6.73514		4	4

A G E R E A D I N G

Date - Time : 08OCT96 - 20:56:21
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD26.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD26WAL.OU1
Data Graphic Files : D:\SASOUT\IOR\AGINGW~1\COD26WAL.DP1/2

Reader : 'READER 3 '
Number data records : 38

Dependent Variable : read
Independ. Variable/s: true (1)

Approx. of True Age : Median
Size Def. : length > 38
Options (PROC REG) : noint

Regression and Tests 2

Model: M1
NOTE: No intercept in model. R-square is redefined.
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	698.15725	698.15725	1370.916	0.0001
Error	37	18.84275	0.50926		
U Total	38	717.00000			

Root MSE	0.71363	R-square	0.9737
Dep Mean	3.86842	Adj R-sq	0.9730
C.V.	18.44750		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|

TRUE	1	0.879291	0.02374802	37.026	0.0001

Dependent Variable: READ

Test: T_TRUE Numerator: 13.1573 DF: 1 F value: 25.8359

Denominator: 0.509263 DF: 37 Prob>F: 0.0001

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1.0000	0.75000	16.5000	0.0000	2
2	2.1429	0.57143	34.4286	17.6383	7
3	2.8750	0.62500	42.5000	12.2975	8
4	3.7143	0.78571	52.0000	13.1371	7
5	4.2500	0.62500	54.2500	29.6072	4
6	5.2500	0.75000	72.7500	18.2367	4
7	5.5000	0.75000	67.0000	38.5695	2
8	7.0000	0.50000	88.0000	.	1
9	7.5000	0.75000	90.0000	9.4281	2
11	10.0000	0.50000	95.0000	.	1

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.0000	2	1.0	0.75000	0	1	11	16.5000	1
2	21.6506	1	0.5	0.62500	1	0	27	42.5000	3
3	0.0000	1	0.5	0.57143	1	0	27	34.4286	2
4	0.0000	2	1.0	0.57143	0	1	30	34.4286	2
5	17.3205	2	1.0	0.62500	0	1	38	42.5000	3
6	0.0000	1	0.5	0.78571	1	0	42	52.0000	4
7	12.3718	1	0.5	0.62500	1	0	48	54.2500	5
8	12.3718	1	0.5	0.62500	1	0	53	54.2500	5
9	0.0000	1	0.5	0.78571	1	0	57	52.0000	4
10	0.0000	1	0.5	0.75000	1	0	72	72.7500	6
11	11.1111	1	0.5	0.75000	1	0	92	90.0000	9
12	0.0000	1	0.5	0.57143	1	0	27	34.4286	2
13	25.0000	2	1.0	0.78571	0	1	37	52.0000	4
14	0.0000	1	0.5	0.62500	1	0	43	42.5000	3
15	32.7327	2	1.0	0.62500	0	1	49	54.2500	5

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	Read Age - True Age

1	1	1.0000	0.87929	-0.1207	0.12071	0.12071	0	0
2	2	2.8750	2.63787	-0.3621	0.23713	-0.63787	-1	1
3	2	2.1429	1.75858	-0.2414	0.38427	0.24142	0	0
4	2	2.1429	1.75858	-0.2414	0.38427	0.24142	0	0
5	3	2.8750	2.63787	-0.3621	0.23713	0.36213	0	0
6	4	3.7143	3.51717	-0.4828	0.19712	0.48283	0	0
7	4	4.2500	4.39646	-0.6035	-0.14646	-0.39646	-1	1
8	4	4.2500	4.39646	-0.6035	-0.14646	-0.39646	-1	1
9	4	3.7143	3.51717	-0.4828	0.19712	0.48283	0	0
10	6	5.2500	5.27575	-0.7243	-0.02575	0.72425	0	0
11	8	7.5000	7.91362	-1.0864	-0.41362	0.08638	-1	1
12	2	2.1429	1.75858	-0.2414	0.38427	0.24142	0	0
13	3	3.7143	3.51717	-0.4828	0.19712	-0.51717	-1	1
14	3	2.8750	2.63787	-0.3621	0.23713	0.36213	0	0
15	3	4.2500	4.39646	-0.6035	-0.14646	-1.39646	-2	2

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	1.1373	0.13728	0.1373	1	0	0
2	2.2746	-0.72544	0.7254	2	-1	1
3	2.2746	0.27456	0.2746	2	0	0
4	2.2746	0.27456	0.2746	2	0	0
5	3.4118	0.41184	0.4118	3	0	0
6	4.5491	0.54912	0.5491	5	1	1
7	4.5491	-0.45088	0.4509	5	0	0
8	4.5491	-0.45088	0.4509	5	0	0
9	4.5491	0.54912	0.5491	5	1	1
10	6.8237	0.82368	0.8237	7	1	1
11	9.0982	0.09824	0.0982	9	0	0
12	2.2746	0.27456	0.2746	2	0	0
13	3.4118	-0.58816	0.5882	3	-1	1
14	3.4118	0.41184	0.4118	3	0	0
15	3.4118	-1.58816	1.5882	3	-2	2

Estim. of means, biases and dispersion 6

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	26.9563	2	1.0	0.75000	0	1	65	72.7500	6
17	0.0000	1	0.5	0.78571	1	0	67	52.0000	4
18	0.0000	1	0.5	0.57143	1	0	29	34.4286	2
19	17.3205	1	0.5	0.62500	1	0	42	42.5000	3
20	0.0000	1	0.5	0.62500	1	0	43	42.5000	3
21	17.3205	1	0.5	0.62500	1	0	46	42.5000	3
22	24.7436	2	1.0	0.78571	0	1	50	52.0000	4
23	31.4918	2	1.0	0.62500	0	1	58	42.5000	3
24	10.8253	1	0.5	0.62500	1	0	67	54.2500	5
25	0.0000	1	0.5	0.75000	1	0	76	67.0000	7
26	0.0000	1	0.5	0.75000	1	0	81	72.7500	6
27	7.5307	1	0.5	0.50000	1	0	88	88.0000	8
28	5.4127	1	0.5	0.50000	1	0	95	95.0000	11
29	0.0000	1	0.5	0.75000	1	0	22	16.5000	1
30	0.0000	1	0.5	0.57143	1	0	38	34.4286	2

Mean

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Read Age - Model Age	Read Age - Residuals	Read Age - True Age	|Read Age - True Age|
16	4	5.2500	5.27575	-0.7243	-0.02575	-1.27575	-2	2
17	4	3.7143	3.51717	-0.4828	0.19712	0.48283	0	0
18	2	2.1429	1.75858	-0.2414	0.38427	0.24142	0	0
19	3	2.8750	2.63787	-0.3621	0.23713	0.36213	0	0
20	3	2.8750	2.63787	-0.3621	0.23713	0.36213	0	0
21	3	2.8750	2.63787	-0.3621	0.23713	0.36213	0	0
22	4	3.7143	3.51717	-0.4828	0.19712	0.48283	0	0
23	3	2.8750	2.63787	-0.3621	0.23713	0.36213	0	0
24	6	4.2500	4.39646	-0.6035	-0.14646	1.60354	1	1
25	7	5.5000	6.15504	-0.8450	-0.65504	0.84496	0	0
26	6	5.2500	5.27575	-0.7243	-0.02575	0.72425	0	0
27	7	7.0000	7.03433	-0.9657	-0.03433	-0.03433	-1	1
28	10	10.0000	9.67220	-1.3278	0.32780	0.32780	-1	1
29	1	1.0000	0.87929	-0.1207	0.12071	0.12071	0	0
30	2	2.1429	1.75858	-0.2414	0.38427	0.24142	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	4.5491	-1.45088	1.4509	5	-1	1
17	4.5491	0.54912	0.5491	5	1	1
18	2.2746	0.27456	0.2746	2	0	0
19	3.4118	0.41184	0.4118	3	0	0
20	3.4118	0.41184	0.4118	3	0	0
21	3.4118	0.41184	0.4118	3	0	0
22	4.5491	0.54912	0.5491	5	1	1
23	3.4118	0.41184	0.4118	3	0	0
24	6.8237	1.82368	1.8237	7	2	2
25	7.9610	0.96096	0.9610	8	1	1
26	6.8237	0.82368	0.8237	7	1	1
27	7.9610	-0.03904	0.0390	8	0	0
28	11.3728	0.37280	0.3728	11	0	0
29	1.1373	0.13728	0.1373	1	0	0
30	2.2746	0.27456	0.2746	2	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	0.0000	1	0.5	0.57143	1	0	42	34.4286	2
32	0.0000	1	0.5	0.62500	1	0	43	42.5000	3
33	24.7436	1	0.5	0.57143	1	0	48	34.4286	2
34	15.7459	2	1.0	0.78571	0	1	49	52.0000	4
35	28.8675	2	1.0	0.75000	0	1	58	67.0000	7
36	0.0000	2	1.0	0.78571	0	1	62	52.0000	4
37	10.1885	2	1.0	0.75000	0	1	73	72.7500	6
38	17.6253	2	1.0	0.75000	0	1	88	90.0000	9

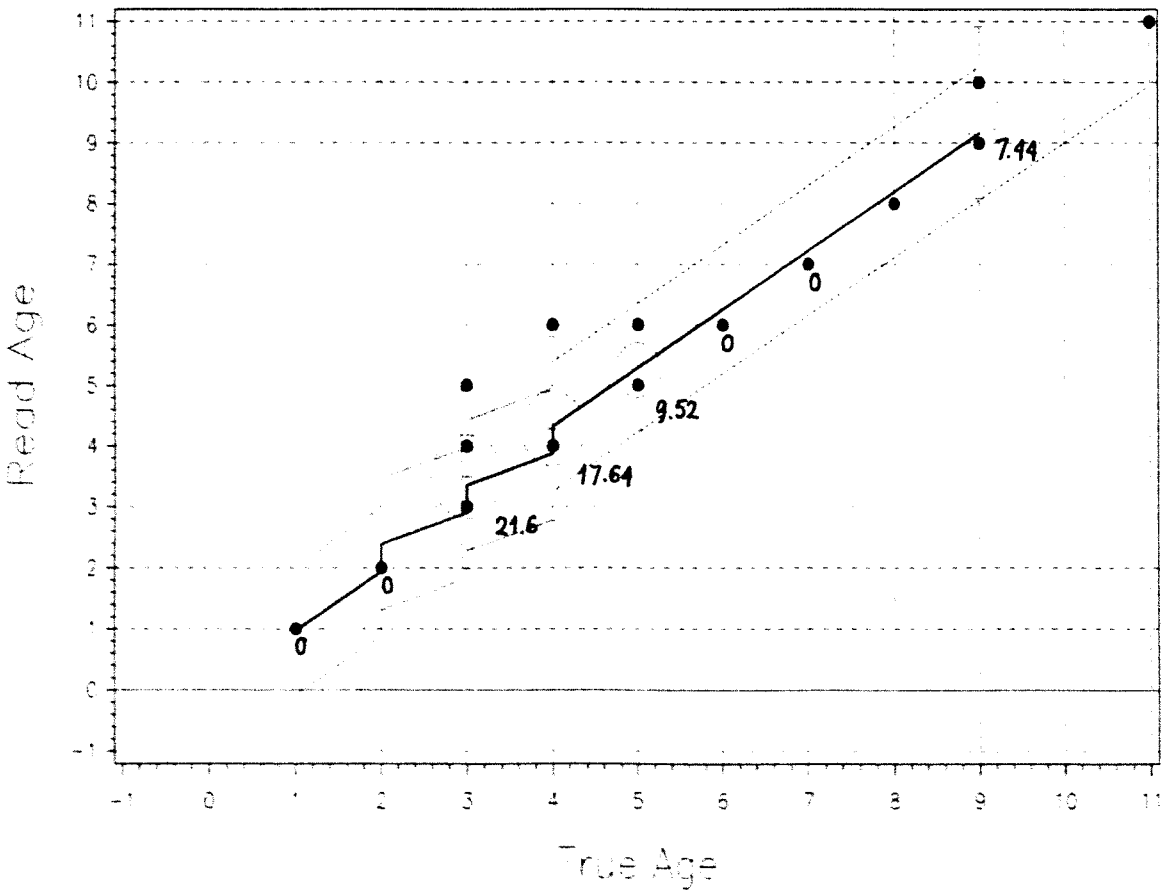
Mean	Estim. Model Age	Mean Read Age	Read Age	|Read Age

Otol. No.	Read Age	Read Age	Model Age	- True Age	- Model Age	Residuals	- True Age	- True Age|
31	2	2.1429	1.75858	-0.2414	0.38427	0.24142	0	0
32	3	2.8750	2.63787	-0.3621	0.23713	0.36213	0	0
33	3	2.1429	1.75858	-0.2414	0.38427	1.24142	1	1
34	3	3.7143	3.51717	-0.4828	0.19712	-0.51717	-1	1
35	4	5.5000	6.15504	-0.8450	-0.65504	-2.15504	-3	3
36	4	3.7143	3.51717	-0.4828	0.19712	0.48283	0	0
37	5	5.2500	5.27575	-0.7243	-0.02575	-0.27575	-1	1
38	7	7.5000	7.91362	-1.0864	-0.41362	-0.91362	-2	2
				-19.6755	3.67553	3.67553	-16	20

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	2.2746	0.27456	0.2746	2	0	0
32	3.4118	0.41184	0.4118	3	0	0
33	3.4118	1.41184	1.4118	3	1	1
34	3.4118	-0.58816	0.5882	3	-1	1
35	4.5491	-2.45088	2.4509	5	-2	2
36	4.5491	0.54912	0.5491	5	1	1
37	5.6864	-0.31360	0.3136	6	0	0
38	7.9610	-1.03904	1.0390	8	-1	1
		4.18010	23.5504		2	20

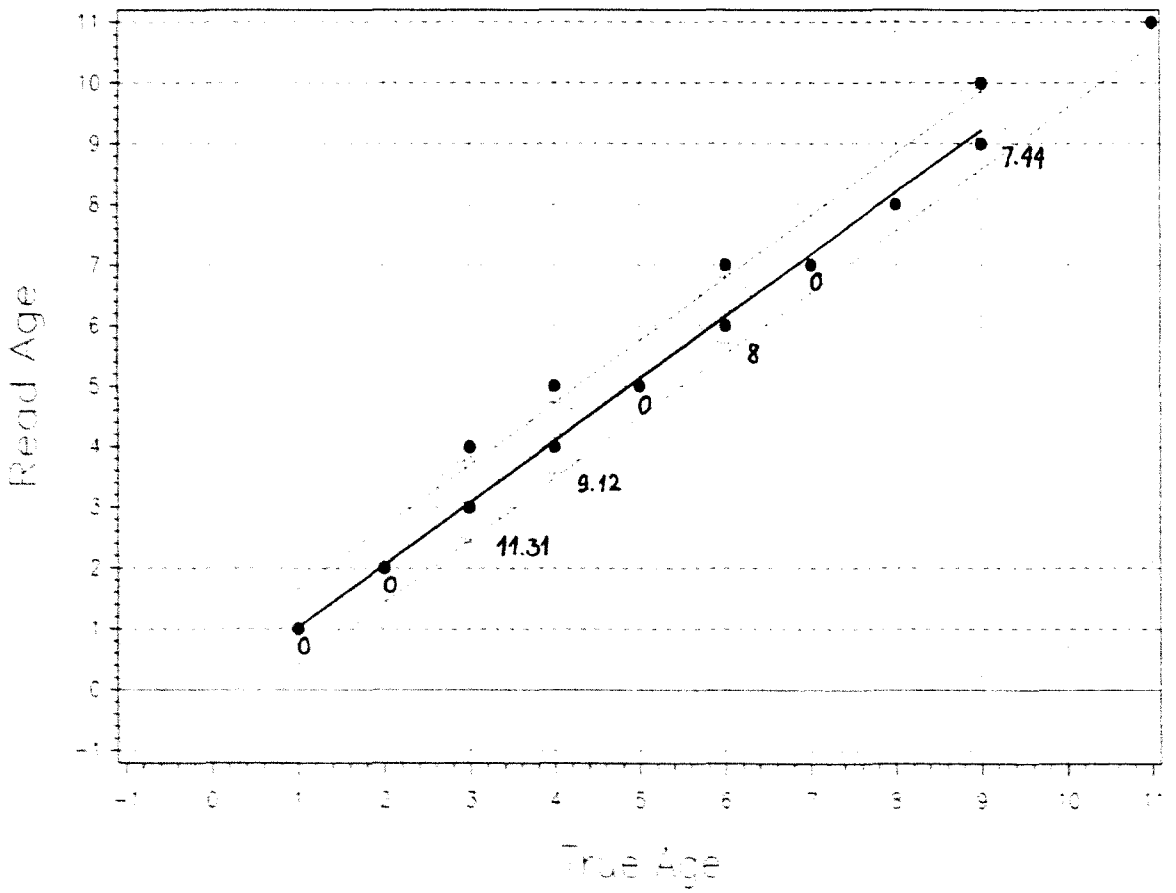
MODEL: read = f (true size) /... noint

(COD26BAR)



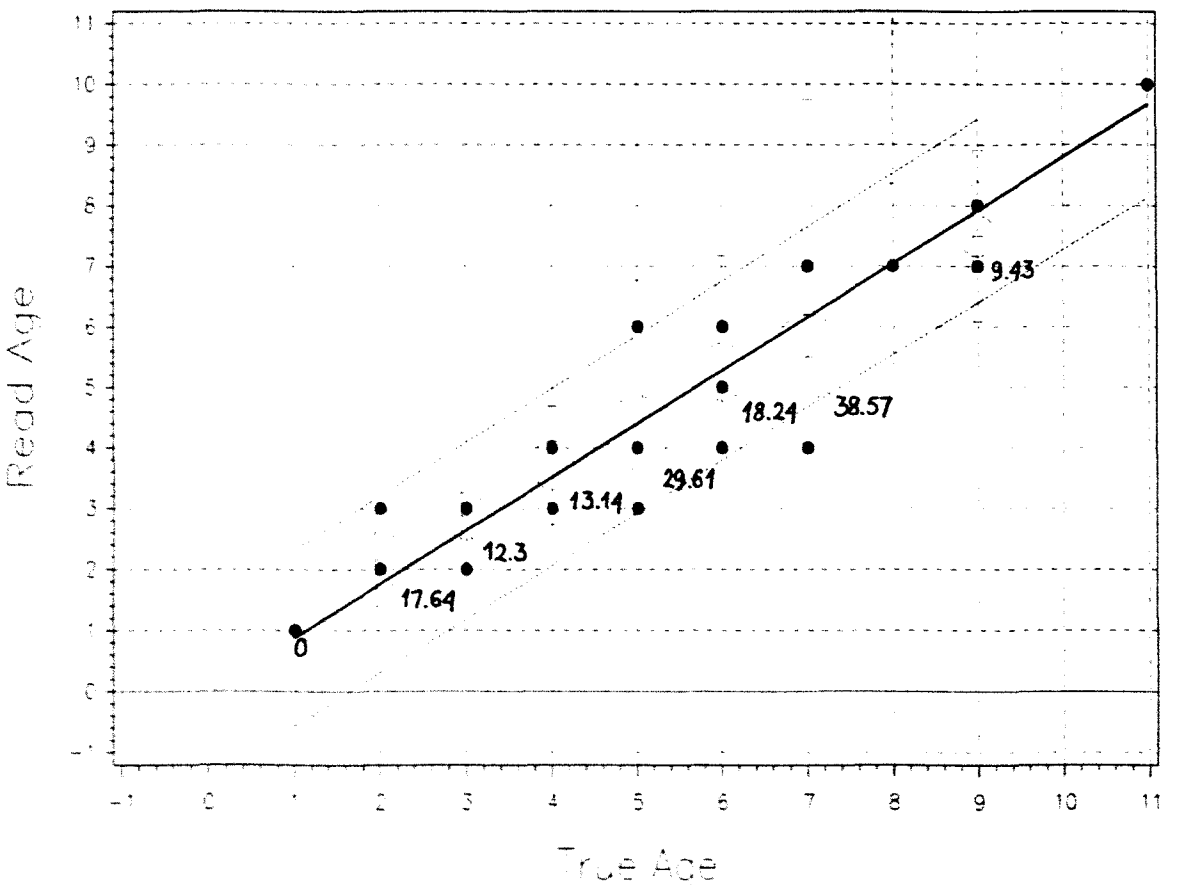
MODEL: read = f (true) /... noint

(COD26NET)



MODEL: read = f (true) /... noint

(COD26WAL)



. SD 28

A G E R E A D I N G

Date - Time : 08OCT96 - 18:50:56
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD28.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\STAT28_1.OUT

Number data records : 126
Approx. of True Age : Median
Width of CV category: 10

2

CVGROUP=1

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
1	10	1	1	1	1.0000	1	0.00000
2	10	2	2	2	2.0000	2	0.00000
3	10	3	2	2	2.0000	2	0.00000
4	10	6	3	3	3.0000	3	0.00000
5	10	17	8	8	8.0000	8	0.00000
6	10	18	1	1	1.0000	1	0.00000
7	10	20	2	2	2.0000	2	0.00000
8	10	21	2	2	2.0000	2	0.00000
9	10	26	3	3	3.0000	3	0.00000
10	10	30	1	1	1.0000	1	0.00000
11	10	31	2	2	2.0000	2	0.00000
12	10	37	4	4	4.0000	4	0.00000
13	10	42	4	4	4.0000	4	0.00000
14	10	29	10	10	10.3333	10	5.58726
15	10	14	7	7	6.6667	7	8.66025

CVGROUP=2

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
16	20	13	6	6	5.66667	6	10.1885
17	20	16	5	5	5.33333	5	10.8253
18	20	27	5	5	5.33333	5	10.8253
19	20	10	5	5	4.66667	5	12.3718
20	20	12	5	5	4.66667	5	12.3718
21	20	25	5	5	4.66667	5	12.3718
22	20	11	4	4	4.33333	4	13.3235
23	20	40	4	4	4.33333	4	13.3235
24	20	5	4	4	3.66667	4	15.7459
25	20	9	4	4	3.66667	4	15.7459
26	20	34	4	4	3.66667	4	15.7459

27	20	28	5	6	6.00000	6	16.6667
28	20	8	3	3	3.33333	3	17.3205
29	20	24	3	3	3.33333	3	17.3205
30	20	36	3	3	3.33333	3	17.3205
31	20	41	7	7	6.33333	6	18.2321

---------- CVGROUP=3 ----------

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
32	30	15	9	9	8.00000	8	21.6506
33	30	22	3	3	2.66667	3	21.6506
34	30	33	3	3	2.66667	3	21.6506
35	30	39	6	6	5.33333	5	21.6506
36	30	4	2	2	2.33333	2	24.7436
37	30	7	2	2	2.33333	2	24.7436
38	30	23	2	2	2.33333	2	24.7436
39	30	35	2	2	2.33333	2	24.7436

---------- CVGROUP=4 ----------

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
40	40	38	3	3	3.66667	4	31.4918

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---------- CVGROUP=4 ----------
(continued)

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
41	40	32	2	3	3	3	33.3333

---------- CVGROUP=5 ----------

OBS	CVLIMIT	FISH	MODE	MEDIAN	MEAN	RMEAN	CV
42	50	19	1	1	1.33333	1	43.3013

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General Linear Models Procedure
Class Level Information

Class	Levels	Values
NATION	3	LV POL SW
TRUE	10	1 2 3 4 5 6 7 8 9 10

Number of observations in data set = 126

General Linear Models Procedure

Dependent Variable: AGE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	513.86957672	46.71541607	172.17	0.0001
Error	114	30.93201058	0.27133343		
Corrected Total	125	544.80158730			

R-Square	C.V.	Root MSE	AGE Mean
0.943223	13.64511	0.5208968	3.8174603

Source	DF	Type I SS	Mean Square	F Value	Pr > F
NATION	2	10.11111111	5.05555556	18.63	0.0001
TRUE	9	503.75846561	55.97316285	206.29	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
NATION	2	10.11111111	5.05555556	18.63	0.0001
TRUE	9	503.75846561	55.97316285	206.29	0.0001

General Linear Models Procedure

Bonferroni (Dunn) T tests for variable: AGE

NOTE: This test controls the type I experimentwise error rate, but generally has a higher type II error rate than REGWQ.

Alpha= 0.05 df= 114 MSE= 0.271333
Critical Value of T= 2.43
Minimum Significant Difference= 0.2762

Means with the same letter are not significantly different.

Bon Grouping	Mean	N	NATION
A	4.0952	42	POL
A			
A	3.9286	42	LV
B	3.4286	42	SW

A G E R E A D I N G

Date - Time : 08OCT96 - 18:12:55
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD28.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD28BAR.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD28BAR.DP

Reader : 'READER 1 '
Number data records : 42

Dependent Variable : read
Independ. Variable/s: true month quarter (3)

Approx. of True Age : Median
Size Def. : length > 38
Options (PROC REG) : noint

Regression and Tests 2

Model: M1
NOTE: No intercept in model. R-square is redefined.
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	3	838.82747	279.60916	2613.465	0.0001
Error	39	4.17253	0.10699		
U Total	42	843.00000			

Root MSE	0.32709	R-square	0.9951
Dep Mean	3.92857	Adj R-sq	0.9947
C.V.	8.32593		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
TRUE	1	0.992104	0.01715608	57.828	0.0001
MONTH	1	-0.313405	0.09259180	-3.385	0.0016
QUARTER	1	0.944328	0.26586441	3.552	0.0010

Regression and Tests 3

Dependent Variable: READ
Test: T_TRUE Numerator: 0.0227 DF: 1 F value: 0.2118
Denominator: 0.106988 DF: 39 Prob>F: 0.6479

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1.0000	0.50000	18.2500	0.0000	4
2	2.0000	0.55556	32.2222	0.0000	9
3	3.3333	0.55556	42.8889	21.2132	9
4	4.0000	0.50000	49.8571	0.0000	7
5	5.2000	0.50000	59.4000	8.6003	5
6	6.0000	0.50000	63.3333	0.0000	3
7	7.0000	0.50000	66.5000	0.0000	2
8	8.0000	0.50000	82.0000	.	1
9	9.0000	0.50000	69.0000	.	1
10	10.0000	0.50000	83.0000	.	1

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.0000	1	0.5	0.50000	1	0	13	18.2500	1
2	0.0000	1	0.5	0.55556	1	0	23	32.2222	2
3	0.0000	1	0.5	0.55556	1	0	25	32.2222	2
4	24.7436	1	0.5	0.55556	1	0	30	32.2222	2
5	15.7459	1	0.5	0.50000	1	0	35	49.8571	4
6	0.0000	1	0.5	0.55556	1	0	36	42.8889	3
7	24.7436	1	0.5	0.55556	1	0	38	32.2222	2
8	17.3205	1	0.5	0.55556	1	0	40	42.8889	3
9	15.7459	1	0.5	0.50000	1	0	43	49.8571	4
10	12.3718	1	0.5	0.50000	1	0	47	59.4000	5
11	13.3235	1	0.5	0.50000	1	0	53	49.8571	4
12	12.3718	1	0.5	0.50000	1	0	55	59.4000	5
13	10.1885	1	0.5	0.50000	1	0	62	63.3333	6
14	8.6603	1	0.5	0.50000	1	0	69	66.5000	7
15	21.6506	1	0.5	0.50000	1	0	69	69.0000	9

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.0000	0.9962	-0.00378	0.00378	0.00378	0	0
2	2	2.0000	1.9883	-0.01168	0.01168	0.01168	0	0
3	2	2.0000	1.9883	-0.01168	0.01168	0.01168	0	0
4	2	2.0000	1.9883	-0.01168	0.01168	0.01168	0	0
5	4	4.0000	3.9725	-0.02747	0.02747	0.02747	0	0
6	3	3.3333	2.9804	-0.01957	0.35291	0.01957	0	0
7	2	2.0000	1.9883	-0.01168	0.01168	0.01168	0	0
8	3	3.3333	2.9804	-0.01957	0.35291	0.01957	0	0
9	4	4.0000	3.9725	-0.02747	0.02747	0.02747	0	0
10	5	5.2000	4.9646	-0.03537	0.23537	0.03537	0	0
11	4	4.0000	3.9725	-0.02747	0.02747	0.02747	0	0
12	5	5.2000	4.9646	-0.03537	0.23537	0.03537	0	0
13	6	6.0000	5.9567	-0.04326	0.04326	0.04326	0	0

14	7	7.0000	6.9488	-0.05116	0.05116	0.05116	0	0
15	9	9.0000	8.9330	-0.06695	0.06695	0.06695	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	1.00381	0.00381	0.00381	1	0	0
2	2.01177	0.01177	0.01177	2	0	0
3	2.01177	0.01177	0.01177	2	0	0
4	2.01177	0.01177	0.01177	2	0	0
5	4.02769	0.02769	0.02769	4	0	0
6	3.01973	0.01973	0.01973	3	0	0
7	2.01177	0.01177	0.01177	2	0	0
8	3.01973	0.01973	0.01973	3	0	0
9	4.02769	0.02769	0.02769	4	0	0
10	5.03565	0.03565	0.03565	5	0	0
11	4.02769	0.02769	0.02769	4	0	0
12	5.03565	0.03565	0.03565	5	0	0
13	6.04361	0.04361	0.04361	6	0	0
14	7.05157	0.05157	0.05157	7	0	0
15	9.06748	0.06748	0.06748	9	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	10.8253	1	0.5	0.50000	1	0	76	59.4000	5
17	0.0000	1	0.5	0.50000	1	0	82	82.0000	8
18	0.0000	1	0.5	0.50000	1	0	17	18.2500	1
19	43.3013	1	0.5	0.50000	1	0	24	18.2500	1
20	0.0000	1	0.5	0.55556	1	0	26	32.2222	2
21	0.0000	1	0.5	0.55556	1	0	33	32.2222	2
22	21.6506	1	0.5	0.55556	1	0	38	42.8889	3
23	24.7436	1	0.5	0.55556	1	0	46	32.2222	2
24	17.3205	1	0.5	0.55556	1	0	48	42.8889	3
25	12.3718	1	0.5	0.50000	1	0	54	59.4000	5
26	0.0000	2	1.0	0.55556	0	1	56	42.8889	3
27	10.8253	1	0.5	0.50000	1	0	65	59.4000	5
28	16.6667	1	0.5	0.50000	1	0	74	63.3333	6
29	5.5873	1	0.5	0.50000	1	0	83	83.0000	10
30	0.0000	1	0.5	0.50000	1	0	19	18.2500	1

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	5	5.2000	4.9646	-0.03537	0.23537	0.03537	0	0
17	8	8.0000	7.9409	-0.05906	0.05906	0.05906	0	0
18	1	1.0000	1.3178	0.31785	-0.31785	-0.31785	0	0
19	1	1.0000	1.3178	0.31785	-0.31785	-0.31785	0	0
20	2	2.0000	2.3100	0.30995	-0.30995	-0.30995	0	0
21	2	2.0000	2.3100	0.30995	-0.30995	-0.30995	0	0
22	3	3.3333	3.3021	0.30206	0.03128	-0.30206	0	0
23	2	2.0000	2.3100	0.30995	-0.30995	-0.30995	0	0
24	4	3.3333	3.6155	0.61546	-0.28213	0.38454	1	1

25	5	5.2000	5.2863	0.28626	-0.08626	-0.28626	0	0
26	3	3.3333	3.3021	0.30206	0.03128	-0.30206	0	0
27	6	5.2000	5.5997	0.59967	-0.39967	0.40033	1	1
28	6	6.0000	6.2784	0.27837	-0.27837	-0.27837	0	0
29	10	10.0000	10.2468	0.24678	-0.24678	-0.24678	0	0
30	1	1.0000	1.0086	0.00856	-0.00856	-0.00856	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	5.03565	0.03565	0.03565	5	0	0
17	8.05953	0.05953	0.05953	8	0	0
18	0.67962	-0.32038	0.32038	1	0	0
19	0.67962	-0.32038	0.32038	1	0	0
20	1.68758	-0.31242	0.31242	2	0	0
21	1.68758	-0.31242	0.31242	2	0	0
22	2.69554	-0.30446	0.30446	3	0	0
23	1.68758	-0.31242	0.31242	2	0	0
24	3.38760	0.38760	0.38760	3	0	0
25	4.71146	-0.28854	0.28854	5	0	0
26	2.69554	-0.30446	0.30446	3	0	0
27	5.40352	0.40352	0.40352	5	0	0
28	5.71942	-0.28058	0.28058	6	0	0
29	9.75125	-0.24875	0.24875	10	0	0
30	0.99137	-0.00863	0.00863	1	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	0.0000	2	1.0	0.55556	0	1	27	32.2222	2
32	33.3333	1	0.5	0.55556	1	0	34	42.8889	3
33	21.6506	1	0.5	0.55556	1	0	39	42.8889	3
34	15.7459	1	0.5	0.50000	1	0	39	49.8571	4
35	24.7436	1	0.5	0.55556	1	0	42	32.2222	2
36	17.3205	1	0.5	0.55556	1	0	45	42.8889	3
37	0.0000	1	0.5	0.50000	1	0	48	49.8571	4
38	31.4918	1	0.5	0.55556	1	0	50	42.8889	3
39	21.6506	1	0.5	0.50000	1	0	54	63.3333	6
40	13.3235	1	0.5	0.50000	1	0	57	49.8571	4
41	18.2321	1	0.5	0.50000	1	0	64	66.5000	7
42	0.0000	1	0.5	0.50000	1	0	74	49.8571	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.0000	2.0007	0.00066	-0.00066	-0.00066	0	0
32	3	3.3333	2.9928	-0.00723	0.34057	0.00723	0	0
33	3	3.3333	2.9928	-0.00723	0.34057	0.00723	0	0
34	4	4.0000	3.9849	-0.01513	0.01513	0.01513	0	0
35	2	2.0000	2.0007	0.00066	-0.00066	-0.00066	0	0
36	3	3.3333	2.9928	-0.00723	0.34057	0.00723	0	0

37	4	4.0000	3.9849	-0.01513	0.01513	0.01513	0	0
38	5	3.3333	3.3062	0.30617	0.02716	1.69383	2	2
39	6	6.0000	6.2825	0.28248	-0.28248	-0.28248	0	0
40	4	4.0000	3.9849	-0.01513	0.01513	0.01513	0	0
41	7	7.0000	6.9612	-0.03882	0.03882	0.03882	0	0
42	4	4.0000	3.9849	-0.01513	0.01513	0.01513	0	0
				4.17511	-0.17511	-0.17511	4	4

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	1.99933	-0.00067	0.00067	2	0	0
32	3.00729	0.00729	0.00729	3	0	0
33	3.00729	0.00729	0.00729	3	0	0
34	4.01525	0.01525	0.01525	4	0	0
35	1.99933	-0.00067	0.00067	2	0	0
36	3.00729	0.00729	0.00729	3	0	0
37	4.01525	0.01525	0.01525	4	0	0
38	4.70731	1.70731	1.70731	5	2	2
39	5.71527	-0.28473	0.28473	6	0	0
40	4.01525	0.01525	0.01525	4	0	0
41	7.03913	0.03913	0.03913	7	0	0
42	4.01525	0.01525	0.01525	4	0	0
		-0.17650	6.42250		2	2

A G E R E A D I N G

Date - Time : 08OCT96 - 18:13:12
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD28.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD28NET.OU1
Data Graphics File : D:\SASOUT\IOR\AGINGW~1\COD28NET.DP

Reader : 'READER 2 '
Number data records : 42

Dependent Variable : read
Independ. Variable/s: true rda_good rectangl (3)

Approx. of True Age : Median
Size Def. : length > 38
Options (PROC REG) : noint

Regression and Tests 2

Model: M1
NOTE: No intercept in model. R-square is redefined.
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	3	895.64447	298.54816	1832.006	0.0001
Error	39	6.35553	0.16296		
U Total	42	902.00000			

Root MSE	0.40369	R-square	0.9930
Dep Mean	4.09524	Adj R-sq	0.9924
C.V.	9.85745		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
TRUE	1	0.990852	0.02924398	33.882	0.0001
RDA_GOOD	1	-0.452344	0.13798876	-3.278	0.0022
RECTANGL	1	0.000143	0.00003778	3.789	0.0005

Dependent Variable: READ

Test: T_TRUE	Numerator:	0.0159	DF:	1	F value:	0.0978
	Denominator:	0.162962	DF:	39	Prob>F:	0.7561

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1.2500	0.62500	18.2500	40.0000	4
2	2.3333	0.72222	32.2222	21.4286	9
3	3.3333	0.61111	42.8889	15.0000	9
4	4.1429	0.50000	49.8571	9.1233	7
5	5.2000	0.60000	59.4000	8.6003	5
6	6.3333	0.83333	63.3333	9.1161	3
7	7.0000	0.75000	66.5000	0.0000	2
8	8.0000	1.00000	82.0000	.	1
9	9.0000	0.50000	69.0000	.	1
10	11.0000	0.50000	83.0000	.	1

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.0000	1	0.5	0.62500	1	0	13	18.2500	1
2	0.0000	1	0.5	0.72222	1	0	23	32.2222	2
3	0.0000	1	0.5	0.72222	1	0	25	32.2222	2

4	24.7436	2	1.0	0.72222	0	1	30	32.2222	2
5	15.7459	1	0.5	0.50000	1	0	35	49.8571	4
6	0.0000	1	0.5	0.61111	1	0	36	42.8889	3
7	24.7436	2	1.0	0.72222	0	1	38	32.2222	2
8	17.3205	2	1.0	0.61111	0	1	40	42.8889	3
9	15.7459	1	0.5	0.50000	1	0	43	49.8571	4
10	12.3718	1	0.5	0.60000	1	0	47	59.4000	5
11	13.3235	1	0.5	0.50000	1	0	53	49.8571	4
12	12.3718	1	0.5	0.60000	1	0	55	59.4000	5
13	10.1885	2	1.0	0.83333	0	1	62	63.3333	6
14	8.6603	1	0.5	0.75000	1	0	69	66.5000	7
15	21.6506	1	0.5	0.50000	1	0	69	69.0000	9

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.2500	1.1634	0.1634	0.08665	-0.16335	0	0
2	2	2.3333	2.1541	0.1541	0.17927	-0.15406	0	0
3	2	2.3333	2.1542	0.1542	0.17913	-0.15420	0	0
4	3	2.3333	2.6065	0.6065	-0.27321	0.39345	1	1
5	4	4.1429	4.1359	0.1359	0.00695	-0.13591	0	0
6	3	3.3333	3.1307	0.1307	0.20259	-0.13074	0	0
7	3	2.3333	2.6065	0.6065	-0.27321	0.39345	1	1
8	4	3.3333	3.5831	0.5831	-0.24975	0.41691	1	1
9	4	4.1429	4.1358	0.1358	0.00709	-0.13576	0	0
10	5	5.2000	5.1266	0.1266	0.07338	-0.12662	0	0
11	4	4.1429	4.1358	0.1358	0.00709	-0.13576	0	0
12	5	5.2000	5.1124	0.1124	0.08755	-0.11245	0	0
13	6	6.3333	6.5700	0.5700	-0.23662	-0.56996	0	0
14	7	7.0000	7.0942	0.0942	-0.09415	-0.09415	0	0
15	9	9.0000	9.0902	0.0902	-0.09017	-0.09017	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	0.8351	-0.16486	0.1649	1	0	0
2	1.8445	-0.15548	0.1555	2	0	0
3	1.8444	-0.15563	0.1556	2	0	0
4	2.3971	0.39708	0.3971	2	0	0
5	3.8628	-0.13716	0.1372	4	0	0
6	2.8681	-0.13195	0.1319	3	0	0
7	2.3971	0.39708	0.3971	2	0	0
8	3.4208	0.42076	0.4208	3	0	0
9	3.8630	-0.13702	0.1370	4	0	0
10	4.8722	-0.12779	0.1278	5	0	0
11	3.8630	-0.13702	0.1370	4	0	0
12	4.8865	-0.11348	0.1135	5	0	0
13	5.4248	-0.57522	0.5752	5	-1	1
14	6.9050	-0.09502	0.0950	7	0	0
15	8.9090	-0.09100	0.0910	9	0	0

Estim. of means, biases and dispersion 6

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class

16	10.8253	2	1.0	0.60000	0	1	76	59.4000	5
17	0.0000	2	1.0	1.00000	0	1	82	82.0000	8
18	0.0000	1	0.5	0.62500	1	0	17	18.2500	1
19	43.3013	2	1.0	0.62500	0	1	24	18.2500	1
20	0.0000	1	0.5	0.72222	1	0	26	32.2222	2
21	0.0000	1	0.5	0.72222	1	0	33	32.2222	2
22	21.6506	1	0.5	0.61111	1	0	38	42.8889	3
23	24.7436	2	1.0	0.72222	0	1	46	32.2222	2
24	17.3205	2	1.0	0.61111	0	1	48	42.8889	3
25	12.3718	1	0.5	0.60000	1	0	54	59.4000	5
26	0.0000	1	0.5	0.61111	1	0	56	42.8889	3
27	10.8253	1	0.5	0.60000	1	0	65	59.4000	5
28	16.6667	2	1.0	0.83333	0	1	74	63.3333	6
29	5.5873	1	0.5	0.50000	1	0	83	83.0000	10
30	0.0000	1	0.5	0.62500	1	0	19	18.2500	1

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	6	5.2000	5.5791	0.5791	-0.37910	0.42090	1	1
17	8	8.0000	8.5514	0.5514	-0.55138	-0.55138	0	0
18	1	1.2500	1.1631	0.1631	0.08694	-0.16306	0	0
19	2	1.2500	1.6014	0.6014	-0.35138	0.39862	1	1
20	2	2.3333	2.1399	0.1399	0.19344	-0.13989	0	0
21	2	2.3333	2.1539	0.1539	0.17942	-0.15392	0	0
22	3	3.3333	3.1448	0.1448	0.18856	-0.14477	0	0
23	3	2.3333	2.5922	0.5922	-0.25890	0.40777	1	1
24	3	3.3333	3.5831	0.5831	-0.24975	-0.58309	0	0
25	5	5.2000	5.1265	0.1265	0.07353	-0.12647	0	0
26	3	3.3333	3.1307	0.1307	0.20259	-0.13074	0	0
27	5	5.2000	5.1124	0.1124	0.08755	-0.11245	0	0
28	7	6.3333	6.5697	0.5697	-0.23634	0.43033	1	1
29	11	11.0000	10.0807	0.0807	0.91926	0.91926	1	1
30	1	1.2500	1.1631	0.1631	0.08694	-0.16306	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	5.4248	0.42478	0.4248	5	0	0
17	7.4435	-0.55647	0.5565	7	-1	1
18	0.8354	-0.16457	0.1646	1	0	0
19	1.4023	0.40230	0.4023	1	0	0
20	1.8588	-0.14118	0.1412	2	0	0
21	1.8447	-0.15534	0.1553	2	0	0
22	2.8539	-0.14611	0.1461	3	0	0
23	2.4115	0.41153	0.4115	2	0	0
24	2.4115	-0.58847	0.5885	2	-1	1
25	4.8724	-0.12764	0.1276	5	0	0
26	2.8681	-0.13195	0.1319	3	0	0
27	4.8865	-0.11348	0.1135	5	0	0
28	6.4343	0.43430	0.4343	6	0	0
29	10.9278	0.92775	0.9278	11	1	1
30	0.8354	-0.16457	0.1646	1	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	0.0000	2	1.0	0.72222	0	1	27	32.2222	2
32	33.3333	1	0.5	0.61111	1	0	34	42.8889	3
33	21.6506	1	0.5	0.61111	1	0	39	42.8889	3
34	15.7459	1	0.5	0.50000	1	0	39	49.8571	4
35	24.7436	1	0.5	0.72222	1	0	42	32.2222	2
36	17.3205	1	0.5	0.61111	1	0	45	42.8889	3
37	0.0000	1	0.5	0.50000	1	0	48	49.8571	4
38	31.4918	1	0.5	0.61111	1	0	50	42.8889	3
39	21.6506	1	0.5	0.83333	1	0	54	63.3333	6
40	13.3235	1	0.5	0.50000	1	0	57	49.8571	4
41	18.2321	2	1.0	0.75000	0	1	64	66.5000	7
42	0.0000	1	0.5	0.50000	1	0	74	49.8571	4

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.3333	2.6063	0.6063	-0.27293	-0.60626	0	0
32	4	3.3333	3.1448	0.1448	0.18856	0.85523	1	1
33	3	3.3333	3.1307	0.1307	0.20259	-0.13074	0	0
34	4	4.1429	4.1216	0.1216	0.02126	-0.12159	0	0
35	2	2.3333	2.1399	0.1399	0.19344	-0.13989	0	0
36	4	3.3333	3.1448	0.1448	0.18856	0.85523	1	1
37	4	4.1429	4.1359	0.1359	0.00695	-0.13591	0	0
38	3	3.3333	3.1451	0.1451	0.18828	-0.14506	0	0
39	6	6.3333	6.1176	0.1176	0.21572	-0.11761	0	0
40	5	4.1429	4.1356	0.1356	0.00724	0.86438	1	1
41	7	7.0000	7.5608	0.5608	-0.56081	-0.56081	0	0
42	4	4.1429	4.1358	0.1358	0.00709	-0.13576	0	0
				11.0101	-0.01006	-0.01006	11	11

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	1.3881	-0.61186	0.6119	1	-1	1
32	3.8631	0.86313	0.8631	4	1	1
33	2.8681	-0.13195	0.1319	3	0	0
34	3.8773	-0.12272	0.1227	4	0	0
35	1.8588	-0.14118	0.1412	2	0	0
36	3.8631	0.86313	0.8631	4	1	1
37	3.8628	-0.13716	0.1372	4	0	0
38	2.8536	-0.14639	0.1464	3	0	0
39	5.8813	-0.11870	0.1187	6	0	0
40	4.8724	0.87236	0.8724	5	1	1
41	6.4340	-0.56599	0.5660	6	-1	1
42	3.8630	-0.13702	0.1370	4	0	0
		-0.01015	12.8386		-1	9

A G E R E A D I N G

Date - Time : 08OCT96 - 18:33:39
Analysing Scientist : Dr. J. Groeger, IOR, BFAFi HRO

Data Input File : D:\DATEN\IOR\AGINGW~1\COD28.TAB
Data Output File : D:\SASOUT\IOR\AGINGW~1\COD28WAL.OU1
Data Graphic Files : D:\SASOUT\IOR\AGINGW~1\COD28WAL.DP1/2

Reader : 'READER 3 '
Number data records : 42

Dependent Variable : read
Independ. Variable/s: true (1)

Approx. of True Age : Median
Size Def. : length > 38
Options (PROC REG) : noint

Regression and Tests 2

Model: M1
NOTE: No intercept in model. R-square is redefined.
Dependent Variable: READ

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	617.86032	617.86032	1396.512	0.0001
Error	41	18.13968	0.44243		
U Total	42	636.00000			

Root MSE	0.66516	R-square	0.9715
Dep Mean	3.42857	Adj R-sq	0.9708
C.V.	19.40035		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
TRUE	1	0.873918	0.02338560	37.370	0.0001

Regression and Tests 3

Dependent Variable: READ
Test: T_TRUE Numerator: 12.8603 DF: 1 F value: 29.0674
Denominator: 0.442431 DF: 41 Prob>F: 0.0001

Estim. of means, biases and dispersion 4

True Age Class	Average Read Age	Average Readab. of Otol.	Average Length	Coeff. of Var. (Reader)	Number of Fish
1	1.0000	0.50000	18.2500	0.0000	4
2	2.1111	0.55556	32.2222	15.7895	9
3	2.6667	0.61111	42.8889	18.7500	9
4	3.7143	0.50000	49.8571	20.3519	7
5	4.4000	0.70000	59.4000	12.4482	5
6	4.6667	0.66667	63.3333	12.3718	3
7	5.5000	0.75000	66.5000	12.8565	2
8	8.0000	0.50000	82.0000	.	1
9	6.0000	0.50000	69.0000	.	1
10	10.0000	0.50000	83.0000	.	1

Estim. of means, biases and dispersion 5

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
1	0.0000	1	0.5	0.50000	1	0	13	18.2500	1
2	0.0000	1	0.5	0.55556	1	0	23	32.2222	2
3	0.0000	1	0.5	0.55556	1	0	25	32.2222	2
4	24.7436	1	0.5	0.55556	1	0	30	32.2222	2
5	15.7459	1	0.5	0.50000	1	0	35	49.8571	4
6	0.0000	2	1.0	0.61111	0	1	36	42.8889	3
7	24.7436	2	1.0	0.55556	0	1	38	32.2222	2
8	17.3205	2	1.0	0.61111	0	1	40	42.8889	3
9	15.7459	1	0.5	0.50000	1	0	43	49.8571	4
10	12.3718	2	1.0	0.70000	0	1	47	59.4000	5
11	13.3235	1	0.5	0.50000	1	0	53	49.8571	4
12	12.3718	2	1.0	0.70000	0	1	55	59.4000	5
13	10.1885	2	1.0	0.66667	0	1	62	63.3333	6
14	8.6603	1	0.5	0.75000	1	0	69	66.5000	7
15	21.6506	1	0.5	0.50000	1	0	69	69.0000	9

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
1	1	1.0000	0.87392	-0.1261	0.12608	0.12608	0	0
2	2	2.1111	1.74784	-0.2522	0.36327	0.25216	0	0
3	2	2.1111	1.74784	-0.2522	0.36327	0.25216	0	0
4	2	2.1111	1.74784	-0.2522	0.36327	0.25216	0	0
5	3	3.7143	3.49567	-0.5043	0.21861	-0.49567	-1	1
6	3	2.6667	2.62176	-0.3782	0.04491	0.37824	0	0
7	2	2.1111	1.74784	-0.2522	0.36327	0.25216	0	0
8	3	2.6667	2.62176	-0.3782	0.04491	0.37824	0	0
9	3	3.7143	3.49567	-0.5043	0.21861	-0.49567	-1	1
10	4	4.4000	4.36959	-0.6304	0.03041	-0.36959	-1	1
11	5	3.7143	3.49567	-0.5043	0.21861	1.50433	1	1
12	4	4.4000	4.36959	-0.6304	0.03041	-0.36959	-1	1
13	5	4.6667	5.24351	-0.7565	-0.57684	-0.24351	-1	1
14	6	5.5000	6.11743	-0.8826	-0.61743	-0.11743	-1	1
15	6	6.0000	7.86527	-1.1347	-1.86527	-1.86527	-3	3

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
1	1.1443	0.14427	0.1443	1	0	0
2	2.2885	0.28854	0.2885	2	0	0
3	2.2885	0.28854	0.2885	2	0	0
4	2.2885	0.28854	0.2885	2	0	0
5	3.4328	-0.56719	0.5672	3	-1	1
6	3.4328	0.43281	0.4328	3	0	0
7	2.2885	0.28854	0.2885	2	0	0
8	3.4328	0.43281	0.4328	3	0	0
9	3.4328	-0.56719	0.5672	3	-1	1
10	4.5771	-0.42291	0.4229	5	0	0
11	5.7214	1.72136	1.7214	6	2	2
12	4.5771	-0.42291	0.4229	5	0	0
13	5.7214	-0.27864	0.2786	6	0	0
14	6.8656	-0.13437	0.1344	7	0	0
15	6.8656	-2.13437	2.1344	7	-2	2

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
16	10.8253	1	0.5	0.70000	1	0	76	59.4000	5
17	0.0000	1	0.5	0.50000	1	0	82	82.0000	8
18	0.0000	1	0.5	0.50000	1	0	17	18.2500	1
19	43.3013	1	0.5	0.50000	1	0	24	18.2500	1
20	0.0000	1	0.5	0.55556	1	0	26	32.2222	2
21	0.0000	1	0.5	0.55556	1	0	33	32.2222	2
22	21.6506	1	0.5	0.61111	1	0	38	42.8889	3
23	24.7436	1	0.5	0.55556	1	0	46	32.2222	2
24	17.3205	1	0.5	0.61111	1	0	48	42.8889	3
25	12.3718	1	0.5	0.70000	1	0	54	59.4000	5
26	0.0000	1	0.5	0.61111	1	0	56	42.8889	3
27	10.8253	1	0.5	0.70000	1	0	65	59.4000	5
28	16.6667	1	0.5	0.66667	1	0	74	63.3333	6
29	5.5873	1	0.5	0.50000	1	0	83	83.0000	10
30	0.0000	1	0.5	0.50000	1	0	19	18.2500	1

Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
16	5	4.4000	4.36959	-0.6304	0.03041	0.63041	0	0
17	8	8.0000	6.99135	-1.0087	1.00865	1.00865	0	0
18	1	1.0000	0.87392	-0.1261	0.12608	0.12608	0	0
19	1	1.0000	0.87392	-0.1261	0.12608	0.12608	0	0
20	2	2.1111	1.74784	-0.2522	0.36327	0.25216	0	0
21	2	2.1111	1.74784	-0.2522	0.36327	0.25216	0	0
22	2	2.6667	2.62176	-0.3782	0.04491	-0.62176	-1	1
23	2	2.1111	1.74784	-0.2522	0.36327	0.25216	0	0
24	3	2.6667	2.62176	-0.3782	0.04491	0.37824	0	0
25	4	4.4000	4.36959	-0.6304	0.03041	-0.36959	-1	1
26	3	2.6667	2.62176	-0.3782	0.04491	0.37824	0	0

27	5	4.4000	4.36959	-0.6304	0.03041	0.63041	0	0
28	5	4.6667	5.24351	-0.7565	-0.57684	-0.24351	-1	1
29	10	10.0000	8.73918	-1.2608	1.26082	1.26082	0	0
30	1	1.0000	0.87392	-0.1261	0.12608	0.12608	0	0

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
16	5.7214	0.72136	0.7214	6	1	1
17	9.1542	1.15417	1.1542	9	1	1
18	1.1443	0.14427	0.1443	1	0	0
19	1.1443	0.14427	0.1443	1	0	0
20	2.2885	0.28854	0.2885	2	0	0
21	2.2885	0.28854	0.2885	2	0	0
22	2.2885	-0.71146	0.7115	2	-1	1
23	2.2885	0.28854	0.2885	2	0	0
24	3.4328	0.43281	0.4328	3	0	0
25	4.5771	-0.42291	0.4229	5	0	0
26	3.4328	0.43281	0.4328	3	0	0
27	5.7214	0.72136	0.7214	6	1	1
28	5.7214	-0.27864	0.2786	6	0	0
29	11.4427	1.44272	1.4427	11	1	1
30	1.1443	0.14427	0.1443	1	0	0

Otol. No.	Otol. Uncert.	Readability of Otol.	Inverted Readab. of Otol.	Average Readab. of Otol.	Good Readab.	Worse Readab.	Fish Length	Average Fish Length	True Age Class
31	0.0000	1	0.5	0.55556	1	0	27	32.2222	2
32	33.3333	1	0.5	0.61111	1	0	34	42.8889	3
33	21.6506	1	0.5	0.61111	1	0	39	42.8889	3
34	15.7459	1	0.5	0.50000	1	0	39	49.8571	4
35	24.7436	1	0.5	0.55556	1	0	42	32.2222	2
36	17.3205	1	0.5	0.61111	1	0	45	42.8889	3
37	0.0000	1	0.5	0.50000	1	0	48	49.8571	4
38	31.4918	1	0.5	0.61111	1	0	50	42.8889	3
39	21.6506	1	0.5	0.66667	1	0	54	63.3333	6
40	13.3235	1	0.5	0.50000	1	0	57	49.8571	4
41	18.2321	2	1.0	0.75000	0	1	64	66.5000	7
42	0.0000	1	0.5	0.50000	1	0	74	49.8571	4

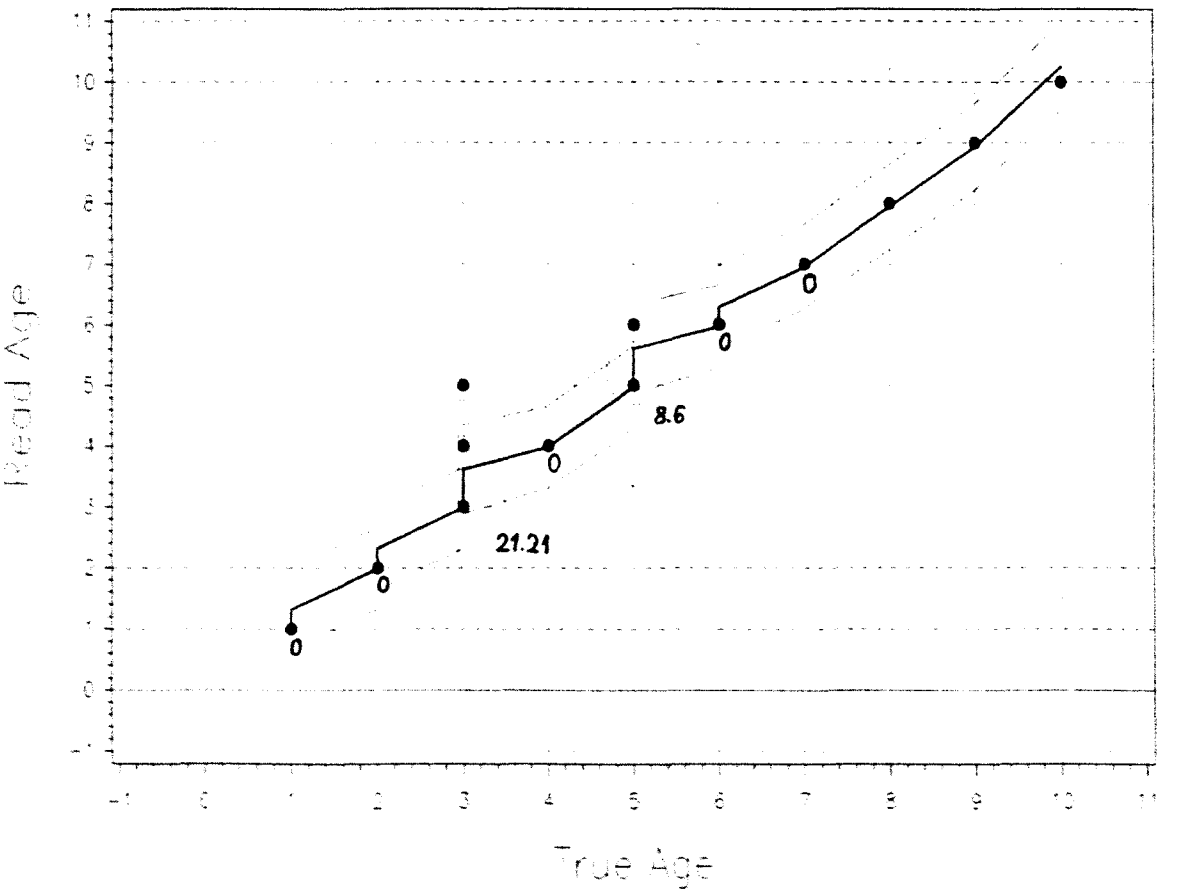
Otol. No.	Read Age	Mean Read Age	Estim. Model Age	Model Age - True Age	Mean Read Age - Model Age	Residuals	Read Age - True Age	|Read Age - True Age|
31	2	2.1111	1.74784	-0.2522	0.36327	0.25216	0	0
32	2	2.6667	2.62176	-0.3782	0.04491	-0.62176	-1	1
33	2	2.6667	2.62176	-0.3782	0.04491	-0.62176	-1	1
34	3	3.7143	3.49567	-0.5043	0.21861	-0.49567	-1	1
35	3	2.1111	1.74784	-0.2522	0.36327	1.25216	1	1
36	3	2.6667	2.62176	-0.3782	0.04491	0.37824	0	0
37	4	3.7143	3.49567	-0.5043	0.21861	0.50433	0	0
38	3	2.6667	2.62176	-0.3782	0.04491	0.37824	0	0

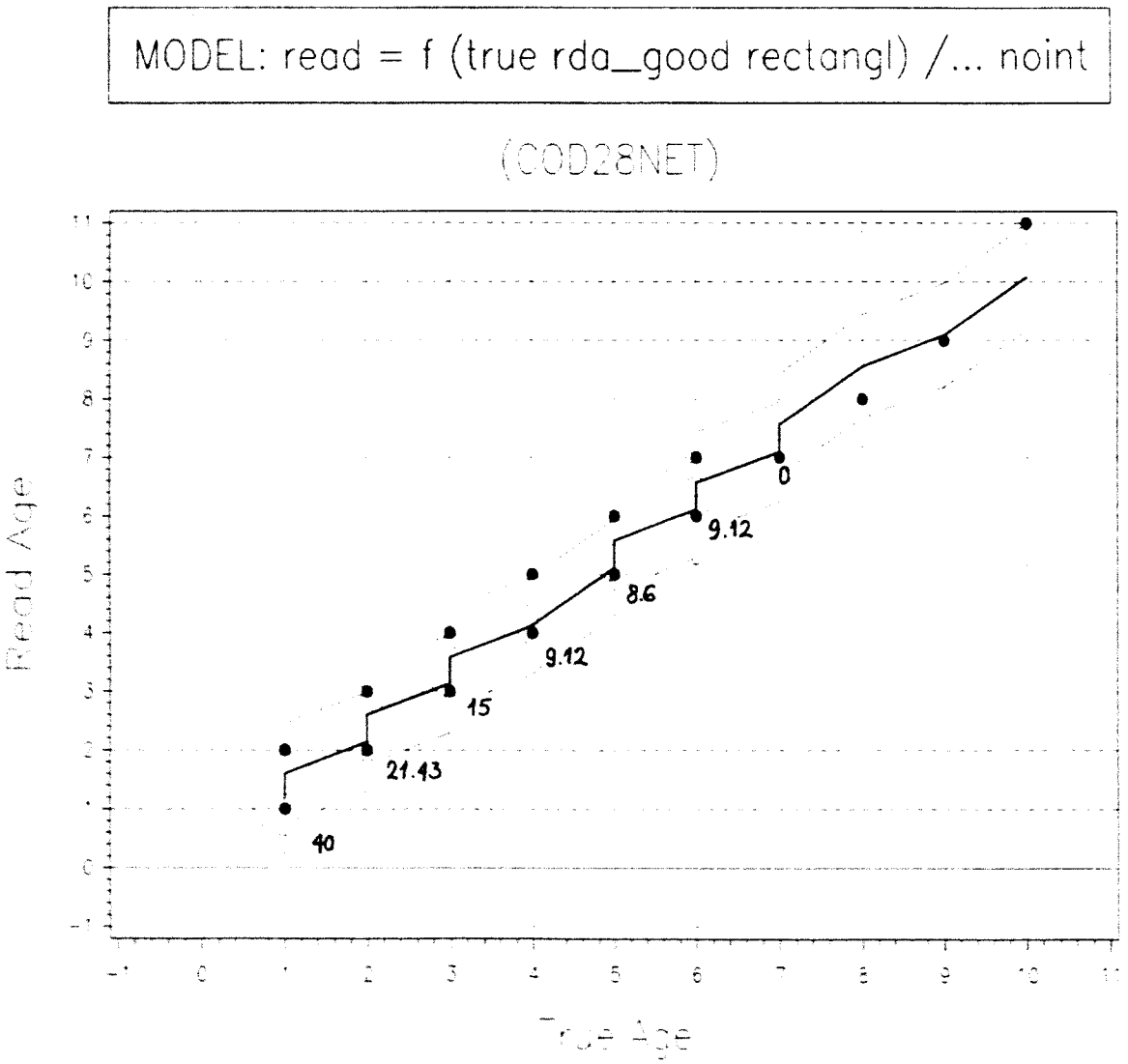
39	4	4.6667	5.24351	-0.7565	-0.57684	-1.24351	-2	2
40	4	3.7143	3.49567	-0.5043	0.21861	0.50433	0	0
41	5	5.5000	6.11743	-0.8826	-0.61743	-1.11743	-2	2
42	4	3.7143	3.49567	-0.5043	0.21861	0.50433	0	0
				-20.2991	3.29913	3.29913	-17	21

Otol. No.	Estim. Age	Estim. Age - True Age	|Estim. Age - True Age|	Estim. Age (rounded)	Estim. Age - True Age (rounded)	|Estim. Age - True Age| (rounded)
31	2.2885	0.28854	0.2885	2	0	0
32	2.2885	-0.71146	0.7115	2	-1	1
33	2.2885	-0.71146	0.7115	2	-1	1
34	3.4328	-0.56719	0.5672	3	-1	1
35	3.4328	1.43281	1.4328	3	1	1
36	3.4328	0.43281	0.4328	3	0	0
37	4.5771	0.57709	0.5771	5	1	1
38	3.4328	0.43281	0.4328	3	0	0
39	4.5771	-1.42291	1.4229	5	-1	1
40	4.5771	0.57709	0.5771	5	1	1
41	5.7214	-1.27864	1.2786	6	-1	1
42	4.5771	0.57709	0.5771	5	1	1
		3.77511	25.0396		0	20

MODEL: read = f (true month quarter) /... noint

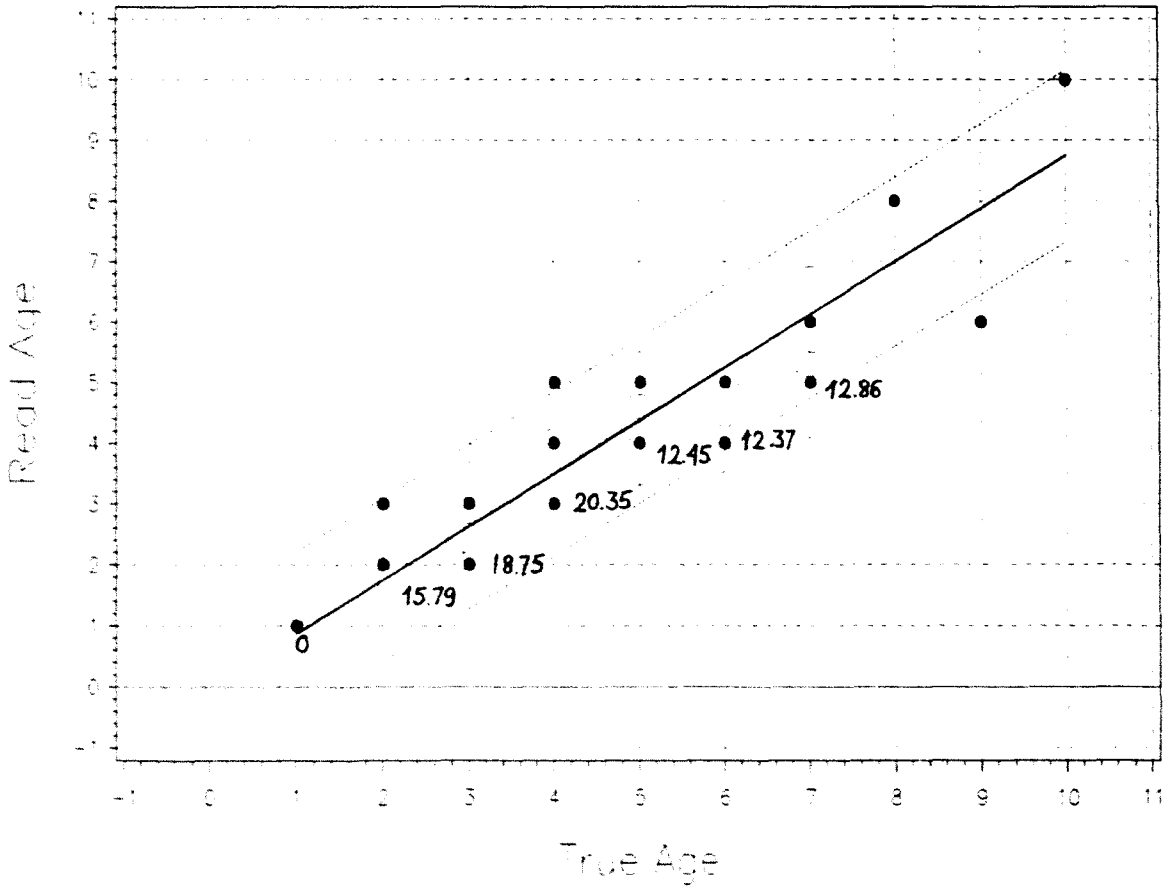
(COD28BAR)




MODEL: read = f (true rda_good rectangl) /... noint
(COD28NET)
Read Age
True Age
40
21.43
15
9.12
8.6
9.12
0

MODEL: read = f (true) /... noint

(COD28WAL)



APPENDIX 1

FORM FOR AGE READING ANALYSES

Page of	

SPECIES:

ICES SUB-DIVISION:

READER Name: Nation: Experience:

METHOD: Illumination (transmitted/reflected):
Moistening mean (alcohol/water/other):
Magnification
:
Preparation of otoliths:

Maturity scale used:

Otol.	Catch date		Rec-	T.length	Sex	Maturity	Characteristic of the otolith			Reada-	Age	Year-
No	Year	Month	tangle	of fish		stage	edge	nucleus	zones	bility		class

CODES for the Age Reading Form

1. Reader experience

   Novice: < 10 000 otholiths, < 6 years
   Experienced reader: 10 000-25 000 otoliths, 7-10 years
   Senior: >25 000 otoliths, > 10 years

2. Sex

   1 male
   2 female

3. Maturity stage: According to the 8-point scale by MAIER.

4. Edge of the otolith

   1 small hyaline zone
   2 full hyaline zone
   3 small opaque zone
   4 wide opaque zone

5. Nucleus

   1 nucleus present
   2 nucleus not present
   3 juvenile zone
   4 no juvenile zone

6. Zones

   1 not variable
   2 variable
      1 ... No of the ring
      H hyaline
      O opaque
      D double ring
      S slim zone
      B broad zone
      N normal zone
      V not visible but expected
      A not sharply outlined
      M hyaline zone consisting of several narrow rings

   Example: 1HDB = 1. ring, hyaline, double zone, broad zone
   3OS = 3. ring, opaque, slim zone

7. Readability

   1 sure
   2 not sure
   3 not readable

APPENDIX 3A

Circular letter

Age Reading Workshop,
Rostock 7th to 11th October 1996

How to handle the selected otolith-collection of Sd 22+24

Dear colleagues,

I would like to ask you to handle the enclosed material as follows:
- copy the reader protocol „Form for Age Reading Analyses" and the „Codes for Age Reading Form" (basis material to send/hand it over to the next reader)

- read the otolith-collection and mark the results in the protocol „Form for Age Reading Analyses" based on the „Codes for Age Reading Form"

- send your results of ageing (only the filled up 'Form for Age Reading Analyse') to me for further analyses and calculations as soon as possible

- send a copy of this protocol to Dr Jan Netzel, Gdynia for controlling the exchange program

- after this, please send/hand over the material (otoliths-collection, the other basis material and this circular letter) to the next institute/labs (see below) to your collegue of your institute

- following institutes/labs are involved in the exchange program of cod otoliths of Sub-divisions 22 and 24.

1. Institut für Ostseefischerei
   An der Jägerbäk 2
   D-18069 Rostock
   GERMANY

2. Baltic Sea Research Station
   Utövägen 5
   S-37137 Karlskrona
   SWEDEN

3. Institute of Marine Research
   Box 4
   S-45321 Lysekil
   SWEDEN

4. Danish Institute for Fishery Research

Charlottenlund Slot
DK 2920 Charlottenlund
DENMARK

This order should also be taken for passing the material to the next reader.

Yours faithfully

Dr Peter Ernst

Procedure for image aided age reading and handling of reference otolith collections.

- Use a binocular microscope to analyse the otolith transections and identify the structures.

- Use the paper print of the transect to indicate the different characteristics described under points 4 to 7 in „CODES for the Age Reading Form".
An example of a reader's interpretation is enclosed.

4) Edge formation.
Mark the width of the outermost zone next to the edge and indicate if it is translucent or opaque.

5) Nucleus or structures formed during the larval phase.
Mark with an arrow the identified location.

6) Annual structures.
Mark what is considered the basic annual identifier (e.g. a translucent zone).
Number it from the centre. Be as exact as possible when defining the **beginning** and the **end** of a given zone.

6D) Additional information about structures:
If an annual structure is considered to consist of multiple structures (e.g. double rings), identify each by an arrow on the print.
Other information considered valuable for the age determination may be added. Be sure to identify all information on the print.

Ensure that your marks are clearly visible even on the very dark background of some prints.

If a given structure is considered problematic identify and mark it out in several radial directions.

Analyse each otolith in the collection and mark out the important features on the corresponing prints. The numbers specific for the otoliths from Sub-Div. 25 are written on the bags in green as #xx.
Fill in the enclosed protocol: „Form for age reading analysis".

Send all **marked prints** together with the **protocol** to me for further analysis.

Send a copy of the **protocol** to Dr Jan Netzel, Gdynia for controlling the exchange program.

After finishing the readings at your institute, please forward only the otolith collection to the next institute on the list below. (Two sets of the protocols as well as the prints have been sent in advance to all involved institutes by me).

Please circulate the cod otolith collection from Sub-Division 25 in the following order:

1. Dr. Peter Ernst
   Institut für Ostseefischerei
   An der Jägerbäk 2
   D-18069 Rostock
   Germany

2. Dr. Jan Netzel
   Sea Fisheries Institute
   Kottataja 1
   81-372 Gdynia
   Poland

3. Ms. Yvonne Walter
   Baltic Sea Research Station
   Utövägen 5
   S-37137 Karlskrona
   Sweden

4. Dr. Bengt Sjöstrand
   Institute of Marine Research
   Box 4
   S-45321 Lysekil
   Sweden

5. Dr Henrik Mosegaard
   Danish Institute for Fisheries Research
   Charlottenlund Slot
   DK-2920 Charlottenlund
   Denmark

Yours sincerely

Henrik Mosegaard

Fig. 1a

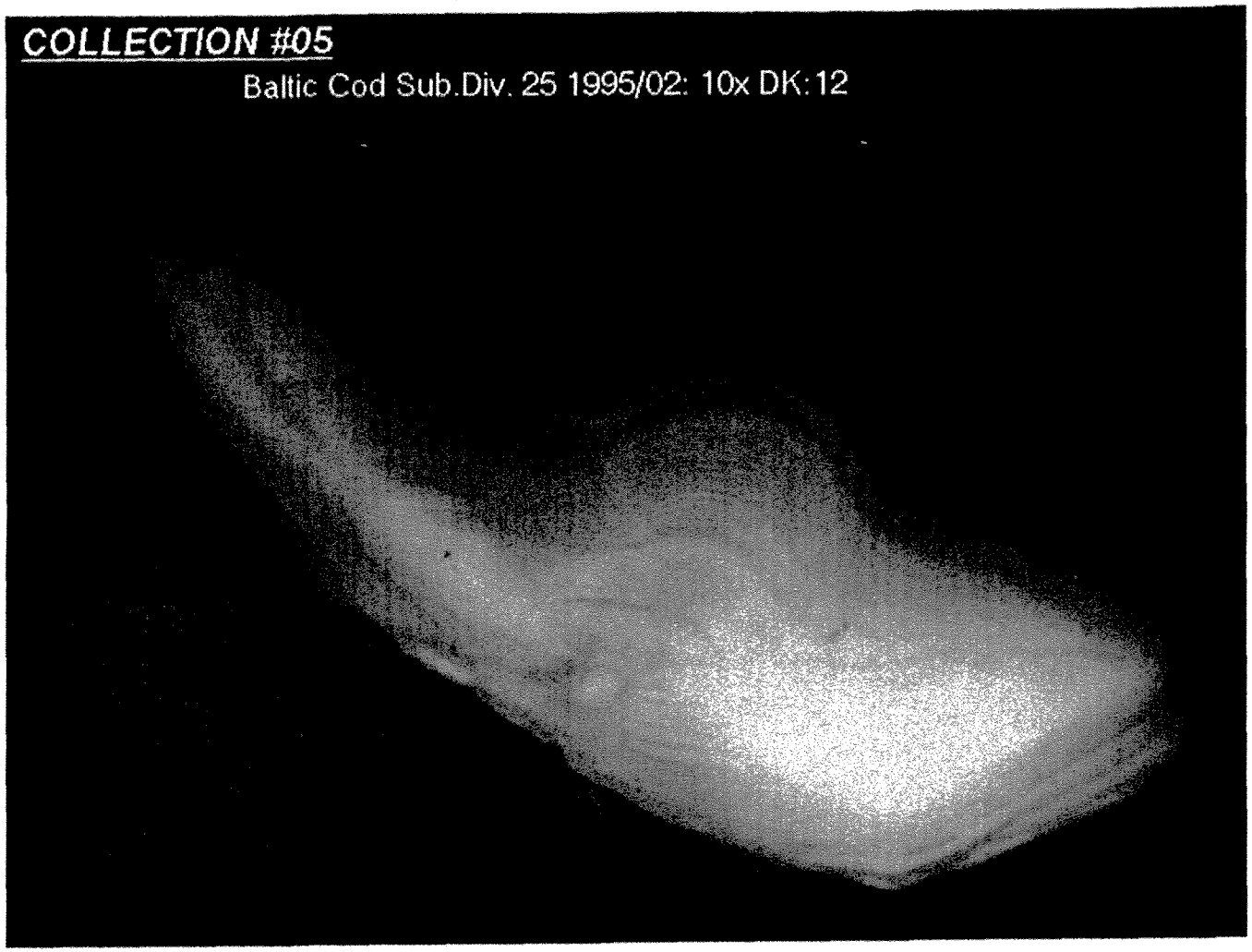


Fig. 1b