Factors related to the Feed Conversion Ratio in Norwegian Salmon Production

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Abstract

We studied the relation between registered factors in a monitoring system and Economic Feed Conversion Ratio. Two factors out of ten were significant; number of days in sea and number of sortings.

Introduction

MonAqua AS operates a benchmarking and monitoring system for increased output in Norwegian salmon production. One way of doing this is to identify factors that contribute to success. Several measures of success have been developed among them the Economic Feed Conversion Ratio (EFCR). EFCR is the number of kilos of feed that are used to produce one kilo of whole saleable fish. Fish farms reporting a low EFCR are usually farms with good management in place, with no overfeeding and low mortality. Low EFCR is thus an indicator of success. MonAqua registers several factors which may have an effect on the EFCR.

Objective

The objective of the study was to find indicators for efficient conversion of feed to saleable fish in Norwegian salmon production.

Methods

Our data were collected over a five year period (1998-2002) and consisted of 775 observations of fish groups (the unit) from 192 fish farms from five regions along the Atlantic coast of Norway. The number of observations per farm varied between 1 and 14 with a mean of 4.04. We studied variables that largely were completely registered i.e. with at least 500 observations. These were: a) Frequency of feeding (0, 1=continuous feeding), b) Size of the cage (m3), c) Age when put to sea (0 or 1 year), d) Supplier of smolt, e) Number of days in sea, f) Use of light (0=no, 1=yes), g) Use of wrasse (0=no, 1=yes), h) Number of sortings (0,1, 2+), i) Type of vaccines (42 types), j) Vaccination against IPN (0=no, 1=yes).

The factors were assessed one by one and also in multivariate analyses. We used mixed model analyses to account for the potential cluster effect of fish farm. Fish farm was included in all analyses as a random variable. The xtmixed procedure in STATA was used. In addition to fish farm the variables were entered one at a time as fixed effects, except for supplier of smolt and type of vaccines that was entered as random variable. Finally all variables that were significant at the 10% level were entered simultaneously in a model.

To illustrate the structure of the data the Figure 1 shows the EFCR for 12 fish farms in one region for the year 2002. There are altogether 36 observations which give an average of 3 observations per farm.

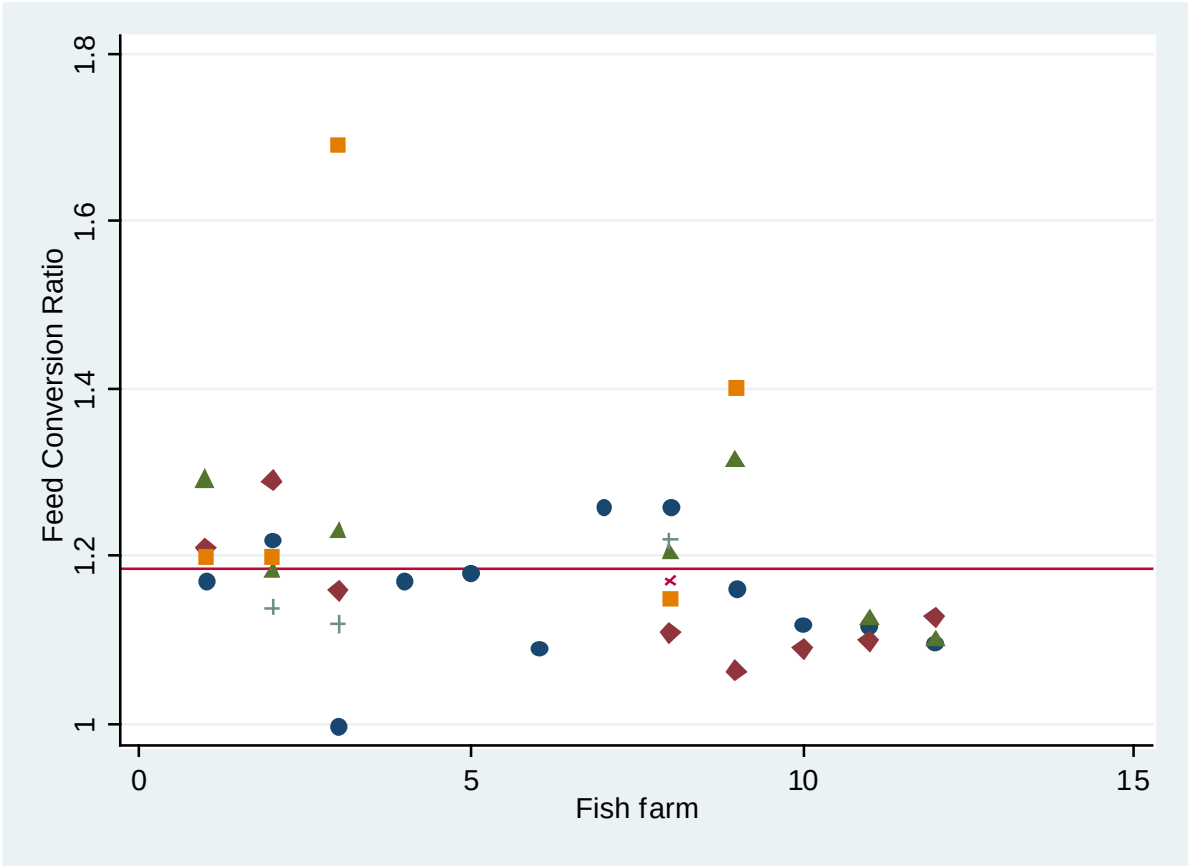

Figure 1 EFCR for 12 fish farms in one region in 2002. The horizontal line is the mean value of all 36 observations..

Results

The mean EFCR of all 775 observations was 1.189. The estimate of the standard deviation of fish farm was 0.1003 with a standard error of 0.0095. This indicates that the EFCR values for the different farms are not drawn from the same distribution. In fact fish farm explains 24% of the total variation of EFCR. Results are presented in Table 1.

Table 1 Table. Estimates from mixed model analyses. Univariate – one variable at a time, multivariate – all variables with p value <0.1 in univariate analysis. Fish farm is included as random variable in all the runs.

	Univariate			Multivariate		
Fixed	**Estimate**	**SE**	**P**	**Estimate**	**SE**	**p**
Frequency of feeding	0,0225	0,0154	0,14			
Size of the cage	1.13e-6	1.89e-6	0.55			
Age when put to sea	-0.0283	0.0210	0.18			
Number of days in sea	0.49e-3	0.085e-3	0.00	0,43e-3	0,07e-3	0,00
Use of light	-0.1329	0.0230	0.00	0,0628	0,0259	0,02
Use of wrasse	-0.0326	0.0205	0.11			
Number of sortings No sorting 1 sorting 2+ sortings	 (Ref) -0,0475 0,0308	 0,0196 0,0311	0,00 0,02 0,32	 -0,0458 0,0380	 (Ref) 0,0190 0,0312	0,00 0,02 0,20
Vaccination against IPN	0.0179	0.0266	0.67			
Random (sd)						
Supplier of smolt	0.0011	0.0017	0.74			
Type of vaccines	0.0256	0.0380	0.75			

Discussion

Two variables were consistently and favourably related to EFCR, fewer days in sea and just one sorting. In addition the EFCR between fish farms varied beyond chance.

The size of the effects is moderate. The estimates reveal that one sorting will move the EFCR down with roughly 0.05 units. This is of the same size as the effect on EFCR potentially obtained by 100 fewer days in sea.

One should keep in mind that there is only an average of four observations within each fish farm. Thus there will be limited power in the study when we condition on fish farm in the analyses. Furthermore the number of observations varied and we selected variables with at least 500 observations. The number of observations also influences the power. Some of the variables that were not significantly related to EFCR might well have become significant with more observations.

In summary this study indicates that accurately registered and relevant information might shed light on potential ways to increase the output in fish farming.