



Table of nitrogen factors for quick frozen fish sticks, fish portions and fish fillets including procedure for determining nitrogen factors.

Background: The Codex Standard for quick frozen fish sticks (fish fingers), fish portions and fish fillets – breaded or in batter (CODEX STAN 166-1989) requires that the proportion of fish content be declared on the label. As specified in the standard, fish content can be estimated by the nitrogen factor end product method. A table of interim nitrogen factors was included in the standard at the 26th Session of Codex Committee on Fish and Fishery Products (CCFFP) and additional fish species were added in subsequent sessions (31st and 32nd Sessions). However, the Codex procedure for accepting new species in the table is time consuming, because studies pertaining to the concerned species are presented to CCFFP and discussions may go on for one or more sessions. If a uniform method is used for obtaining data, discussion could be briefer, but often this is not the case.

The natural levels of protein (and therefore, nitrogen) in fish flesh could vary depending on factors such as location of catch, season, size, spawning cycle and nutrition. In the case of farmed fish, culture conditions could affect nitrogen content. Currently, a +/-10% allowance for natural variation has been provided in the Codex Standard. However, it has been felt by many member countries that the allowance does not cover all natural variance observed and it has been suggested that the allowance should be statistically based and should cover 2 standard errors about the mean (approximately 95% of the distribution).

When fish are handled under good manufacturing practice (GMP), they are exposed to water and this may affect the nitrogen content. There are different views on whether nitrogen content should be based on fish that has not been exposed to water or ice or on fish handled under GMP conditions. Thus the data generated on nitrogen factor should consider these variables.

The 34th Session of CCFFP confirmed the decision of 33rd Session to remove the table of nitrogen factors from the standard and to make it available for use by members through FAO website. The 34th Session requested FAO to develop a table of nitrogen factors that would include the data that was part of CODEX STAN 166-1989 and other statistical information from available data. The Committee desired that the Table should be a living document that can be updated as data becomes available from peer reviewed publications.

The tables below have been updated in December 2016:

Nitrogen Factor of Tilapia

Name of the institution/company/laboratory providing the data	Thailand and Malaysia Governments
Fish species studied	<i>Oreochromis spp</i> (Tilapia) Species not detailed
Farmed or caught	Farmed
In case of farmed fish, specify farming conditions	Earthen ponds and cage culture
Harvesting areas	Thailand – 10 provinces - Chachoengsao, Prachin Buri, Suphan Buri, Kanchanaburi, Nakhon Pathom, Ratchaburi, Phetchaburi, Nakhon Nayok, Samut Prakan and Samut Sakhon. Malaysia - 10 States of the Malaysian peninsular Chachoengsao, Prachin Buri, Suphan Buri, Kanchanaburi, Nakhon Pathom, Ratchaburi, Phetchaburi, Nakhon Nayok, Samut Prakan and Samut Sakhon.
Harvesting dates	Not detailed, but throughout 2010
Type of fish product analysed to derive nitrogen factor	Thailand – manually filleted skinless tilapia from farms and markets. Also commercially prepared GMP skinless fillets and block frozen fillets. Malaysia – manually filleted skinless tilapia from farms.
Sample type (e.g. one fillet, 250gm of block)	Thailand – one fillet from whole fish. Malaysia – 3 (500g) sub samples of homogenised fish take from batch of 8-10 fish
Number of samples	Thailand – 80 samples of fish, also combined with earlier study of 216 analyses of dry fillets, iced fish, And washed and frozen fillet blocks Malaysia – 23 samples of batches of fish.
Nitrogen Factor and Standard deviation	Thailand (40 samples) fillet $2.92^* \pm 0.12^{**}$ Malaysia (14 samples) $2.76^* \pm 0.33^{**}$ Combined $2.88^* \pm 0.17^{**}$
Method of Analysis	Kjeldahl based on AOAC(2000) 928.08

* Nitrogen factor when analysed by Kjeldahl method

** One Standard Deviation

Nitrogen Factor of South Atlantic Hake

Name of the institution/ company/ laboratory providing the data	South African Government, South African Deep Sea Trawling Industry Association
Fish species studied	<i>Merluccius paradoxus</i> and /or <i>Merluccius capensis</i> (South Atlantic Hake (not specified))
Farmed or caught	Caught at sea
In case of farmed fish, specify farming conditions	Not applicable
Harvesting areas	South Africa – West Coast FAO 47 South Africa – South East Coast FAO 47
Harvesting dates	October 2011 and May 2012
Type of fish product analysed to derive nitrogen factor	H&G fish straight from sea only iced Commercially prepared GMP fillet GMP processed fresh mince GMP processed fillet and mince frozen blocks
Sample type (e.g. one fillet, 250gm of block)	12 H&G fish hand filleted, homogenised and 3 samples for analysis. 12 x500g samples of machine fillet skinless. 12x500g samples of machine prepared fresh mince 12x500g samples from frozen fillet and mince block
Number of samples	16 samples of each of H&G hand fillet, machine fillet and fresh mince 18 samples of frozen fillet and mince blocks
Nitrogen Factor and Standard deviation	H&G hand fillet 2.60 *± 0.26 Machine fillet and skin removed 2.60*± 0.25 Machine fresh mince 2.38*± 0.21 Frozen fillet block 2.46*± 0.20 Frozen mince block 2.32*± 0.27 Recommended factor S. Atlantic hake 2.45
Method of Analysis	British Standard 4401, ISO 937:1978 (Kjeldahl)

* Average Nitrogen content g/100g. One Standard Deviation calculated from Codex paper data

Nitrogen Factor of Alaska Pollack

Name of the institution/company/laboratory providing the data	UK Royal Society of Chemistry Analytical Methods Committee
Fish species studied	<i>Theragra chalcogramma</i> (Pallas) (Alaska pollack)
Farmed or caught	Caught at sea
In case of farmed fish, specify farming conditions	Not applicable
Harvesting areas	Bering Sea Russian sector FAO 61 Bering Sea US sector FAO 67
Harvesting dates	Whole Alaska Pollack Sept. 2012 Alaska Pollack for blocks March and Sept 2012
Type of fish product analysed to derive nitrogen factor	Dry fillet straight from sea only frozen and thawed Commercially prepared GMP fillet and mince frozen blocks (7.5kg)
Sample type (e.g. one fillet, 250gm of block)	250g of homogenised sample from 2 fillets of 1 whole A. Pollack fish. 240g homogenised sample from section cut from 7.5kg block
Number of samples	75 samples of whole A. Pollack 75 samples of A. Pollack fillet blocks 75 samples of A. Pollack mince blocks
Nitrogen Factor and Standard deviation	Whole Alaska Pollack 2.80 (2.75)* \pm 0.05** Alaska Pollack fillet block 2.70(2.65)* \pm 0.04** Alaska Pollack mince block 2.50 (2.45)* \pm 0.04**
Method of Analysis	British Standard 4401, ISO 937:1978 (Kjeldahl) or equivalent Dumas

* Nitrogen factor when analysed by Kjeldahl method

* 2x Standard Error

Nitrogen Factor of Cod

Name of the institution/company/laboratory providing the data	UK Royal Society of Chemistry Analytical Methods Committee
Fish species studied ¹	<i>Gadhus morhua</i> (Atlantic cod)
Farmed or caught	Caught at sea
In case of farmed fish, specify farming conditions	
Harvesting areas ²	Barents Sea (FAO 27-IIa and b) and Norwegian (FAO 27 – IIa and IVa) Imported blocks see Table 5 in paper
Harvesting dates	UK cod sampled spring and autumn Dec 2001 to Sept 2003
Type of fish product analysed to derive nitrogen factor ³	Cod fillet (frozen/thawed) no other processing UK cod blocks fillet and mince Imported cod fillet and mince blocks, single and double frozen
Sample type (e.g. one fillet, 250gm of block)	300g composite samples from fillet/mince, 1.5kg composite sample from blocks
Number of samples	80 samples dry fillet, 80 UK fillet blocks, 80 UK mince blocks, 17 imported fillet blocks (7 countries see Table 5 of paper)
Nitrogen Factor and Standard deviation	Cod fillet straight from sea 2.85 (0.06)* UK fillet blocks 2.78 (0.06)*, UK mince block 2.78 (0.06)*, Imported fillet block 2.75 , Imported mince block 2.65
Method of Analysis	British Standard 4401, ISO 937:1978 (Kjeldahl) or equivalent Dumas

* Least Significant Difference at 5% level

Nitrogen Factor of Scampi

Name of the institution/company/laboratory providing the data	UK Royal Society of Chemistry Analytical Methods Committee
Fish species studied	<i>Nephrops norvegicus</i> (scampi)
Farmed or caught	Caught at sea –
In case of farmed fish, specify farming conditions	Not applicable
Harvesting areas	North Sea (FAO 27-IVa) and Irish Sea (FAO 27 – VIIa)
Harvesting dates	Samples taken over a period of 16 month period
Type of fish product analysed to derive nitrogen factor	Scampi tails shell off straight from sea Scampi tails shell off after GMP process
Sample type (e.g. one fillet, 250gm of block)	Composite sample of tails (shell off) taken from 5kg batches
Number of samples	70 samples (35 from each catch area)
Nitrogen Factor and Standard deviation	Scampi straight from sea 2.90 (0.08)* Scampi after GMP storage & processing 2.45 (0.08)*
Method of Analysis	British Standard 4401, ISO 937:1978 (Kjeldahl) or equivalent Dumas

* Least Significant Difference at 5% level

Nitrogen Factor of Pangasius

Name of the institution/company/laboratory providing the data	UK Royal Society of Chemistry Analytical Methods Committee
Fish species studied	<i>Pangasius hypophthalmus</i> (Pangasius)
Farmed or caught	Farmed
In case of farmed fish, specify farming conditions	All pond farmed – local feeding regimes
Harvesting areas	Whole fish only frozen and thawed - from Cao Lanh and Long Xuyen regions of Vietnamese Mekong Delta. Commercially prepared fillets GMP – from plants in same 2 areas of Mekong Delta
Harvesting dates	Whole Pangasius – Oct. 2011 and July 2012 Commercial fillets - Dec. 2011 and March/April 2012
Type of fish product analysed to derive nitrogen factor	Dry Pangasius fillet only frozen and thawed Commercially prepared GMP fillet frozen and thawed – 10kg cartons
Sample type (e.g. one fillet, 250gm of block)	250g of homogenised sample from 2 fillets of 1 fish. 250g homogenised sample from 3 fillets taken at random from carton.
Number of samples	75 samples of whole Pangasius 75 samples of 10kg cartons of commercially prepared fillets.
Nitrogen Factor and Standard deviation	Dry Pangasius fillet 2.85 (2.80)* ± 0.04** Commercial fillets 2.70 (2.65)* ± 0.05**
Method of Analysis	British Standard 4401, ISO 937:1978 (Kjeldahl) or equivalent Dumas

* Nitrogen factor when analysed by Kjeldahl method

** 2x Standard Error

Nitrogen Factor of Atlantic Salmon

Name of the institution/company/laboratory providing the data	Government Chemist Programme, LGC Ltd, Teddington, UK
Fish species studied	<i>Salmo salar</i> (Atlantic salmon)
Farmed or caught	Farmed
In case of farmed fish, specify farming conditions	All farmed in Scottish lochs and Norwegian fjords
Harvesting areas	Scotland and Norway
Harvesting dates	Fillets and Mince blocks Dec. 2006, March, June, September 2007
Type of fish product analysed to derive nitrogen factor	Skinless fillets from whole fish – from large (4-5kg), medium (3-4kg) and small (2-3kg) fish Commercially prepared GMP (under inspection) fillets – from large, medium and small fish Commercially prepared mince and mince block
Sample type (e.g. one fillet, 250gm of block)	One fillet from whole – large, medium small fish One kg of commercial fillets - neck, middle, tail cuts from large, medium, small fish. 9x1kg samples of frame mince from machine 3x 7.5kg mince blocks from 3 commercial runs
Number of samples	36 samples of fillets from whole fish 18 samples of commercially prepared fillets. 9 samples of mince from machine 9 samples of commercial mince blocks
Nitrogen Factor and Standard deviation	Salmon fillet (hand or commercially prepared) Fat –free nitrogen 2.80 (2.75)* \pm 0.08** Frame mince fat free N 2.85 (2.81)* \pm 0.28***
Method of Analysis	British Standard 4401, ISO 937:1978 (Kjeldahl) or equivalent Dumas

* Nitrogen factor when analysed by Kjeldahl method

** 2xStandard Error

*** 2x Standard Error and Large seasonal variation found for mince blocks