

In the Shadow of Live Weight Conversion Factors: Critical Assumptions in Catch Data

Summary: Impact of live weight conversion factors on catch estimates

Commercial fish products are often directly processed onboard vessels and, by the time they are landed, the fish have been frozen, gutted, headed, prepared, and/or processed, leading to a considerable change from their original weight. To estimate the amount of live fish that was taken out of the water, the weight of landed processed products must be converted into the assumed weight of whole, live, and unprocessed fish using conversion factors. These **'live weight conversion factors'** allow for the evaluation of species catch data across diverse landed product forms, and this is central to fisheries management and critical to estimate the amount of biomass harvested from wild populations. Despite their unquestionable utility, conversion factor values can be prone to inconsistencies, sometimes leading to incorrect 'live weight' measurements, and if they are not regularly assessed and re-evaluated, their use could lead to an under- or over-estimation of catch estimates, with important consequences on fisheries management.

Within the European Union (EU), **there is substantial variability in conversion factors at EU and Member**

State levels, which can result in considerable differences in the way 'live weight' is reported and fisheries catch evaluated. EU fishers are required to report live weight in fishing logbooks and landing declarations after multiplying processed weight by the appropriate conversion factor. However, out of the top 1600 landed species in the EU, only 629 have EU conversion factors, and for fish families where Member State national conversion factors apply, inconsistencies in values can be substantial. Furthermore, EU operators are not currently requested to report the conversion factors they use to evaluate the live weight of their catch.

Similarly, substantial variability in conversion factors exist between the EU and importing third (non EU) countries. Catch certificates used in the international trade of seafood products must include estimated 'live weight', and mentions of net weight (landed weight) are currently ambiguous. Information on conversion factors is not requested making any verification, back-calculation, or re-evaluation of live weight virtually impossible.

Administrative documents for domestic landings, such as logbooks and landing declarations, and for trade such as catch certificates represent an important step for tracking catch volumes. Considering the importance of reliable catch data for fisheries management, we recommend improved transparency on conversion factors, and propose that the EU ensure that:

1. In the context of EU domestic products, conversion factors are reported in fishing logbooks and landing declarations alongside estimated live weight for each species.
2. In the context of traded products and should live weight continue to be reported, conversion factors are reported on catch certificates. We do however support Amendment 1123 to Regulation (EC) No 1005/2008 Annex II which proposes that net weight be reported on catch certificates instead of live weight.
3. Conversion factors used for domestic products are defined by the EU for all landed species and all processing methods, to ensure comparability.
4. The source of the conversion factors is provided in the fishing logbooks, landing declarations, and catch certificates allowing for better identification of discrepancies between Member States, EU, and/or third country values.

Box 1. Definitions

Landed weight (or net weight):	The weight of product at the time of landing, regardless of the state (e.g., fresh or frozen) and presentation (e.g., whole, gutted, filleted, etc.)
Live weight:	The estimated catch based on the use of a live weight conversion factor
Live weight conversion factor:	The value by which net weights are multiplied to convert to live weight

Domestic EU Landings

Determining a conversion factor value for a given species is a lengthy scientific process undertaken infrequently by regional, national, and/or academic institutions as well as regional fisheries management organisations (RFMOs), sometimes leading to outdated values.

The conversion factors themselves are typically applied by multiplying the weight of fish landed, often after some amount of processing (e.g., removal of head or guts, freezing, drying, etc.), by a “**live weight conversion factor**” value. For example, 40 tonnes of headed and gutted fish with an associated conversion factor of 2.5 would result in an estimated 100 t of catch. (Fig. 1). Converting landings to the live weight equivalent is necessary because patterns in landed weight will vary substantially with differences in processing prior to landing. The estimated live weight will then serve as the catch estimate and will be used in fisheries management to evaluate fishing mortality, species composition, catch per unit effort, and to monitor quotas.

Seemingly small numerical differences in live weight conversion factors can result in large differences in estimated catch. For example, if we take the aforementioned 40 t of headed and gutted fish and apply a modified live weight conversion factor of 3.3, we would then estimate 132 t of catch, or an additional 32 t compared to the previously estimated 100 t. Despite the drastic shift in estimated catch resulting from such seemingly minor differences in live weight conversion factors, these values are not usually reported alongside estimated catch. **Further, once a catch is aggregated by species or taxonomic group, the information on processing at landing is lost, making it impossible to re-estimate the catch using a different set of live weight conversion factors from the catch data alone. As a result, unreported live weight conversion factors represent a set of critical underlying assumptions in catch data that inhibit data reproducibility and transparency, ultimately impeding the reliable management of fisheries resources.**

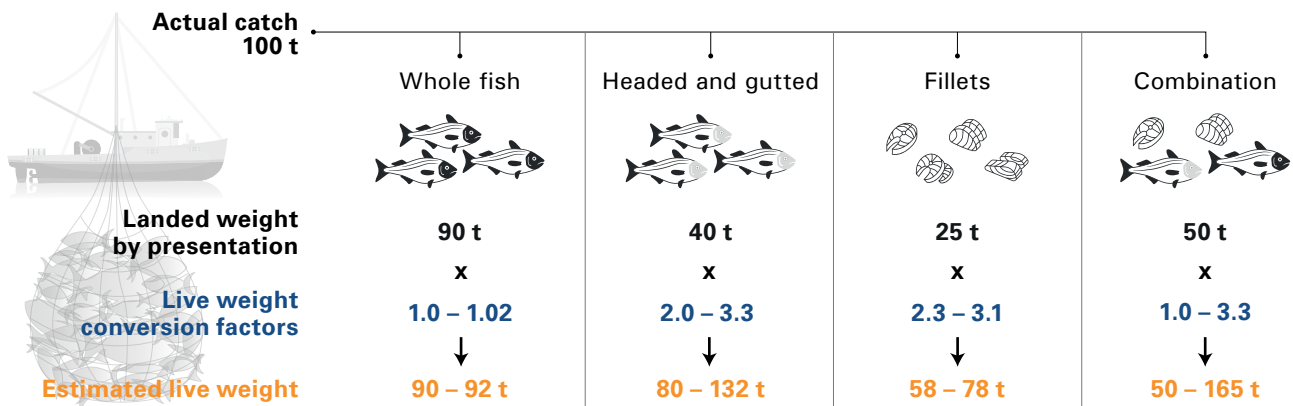


Fig. 1: Illustration of estimated live weight for different presentations and ranges of live weight conversion factors.

Box 2. EU Atlantic cod

The fleet fishing for Atlantic cod (*Gadus morhua*) often processes cod onboard, making the use of conversion factors particularly relevant for that species. With the recent depletion of some stocks in the North-East Atlantic, an accurate estimation of live weight catch data is critical for the sustainable management of these stocks. As illustrated in Fig. 2 however, there is variability in the estimated live weight based on the Member State versus the EU-wide conversion factor.

By summing up the various conversion factors across different processing methods, the total Atlantic cod catch can be estimated for Member States and for the EU. When summing up values from 2015 across the entire EU and comparing the minimum versus maximum available conversion factors, the discrepancy for estimated live weight of cod was 12273 t.

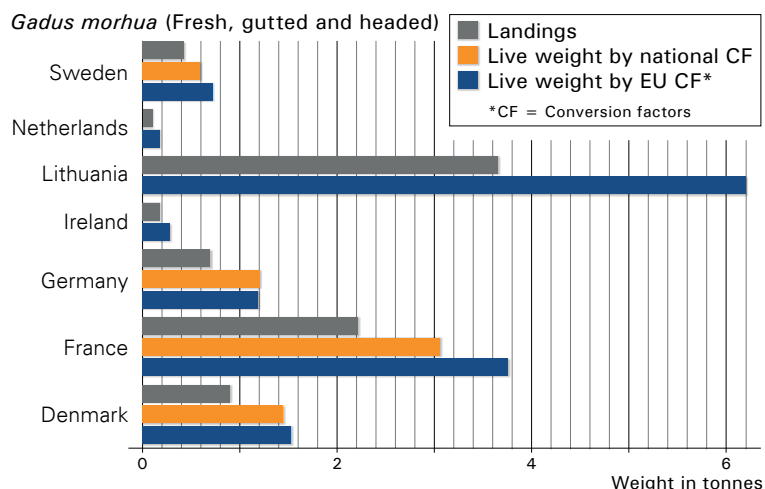


Fig. 2: Landings and estimated live weight using national and EU-wide conversion factors for fresh, gutted and headed Atlantic cod.



Fig. 3: Live weight conversion factors for select species, states, and presentations for which there is an EU-wide conversion factor.

There is substantial variability in existing live weight conversion factor values within the EU Member States and other European countries such as the United Kingdom or Norway, and that can result in important differences in estimated catch (Boxes 2 & 3; Figures 2-4). This range does not necessarily mean that the values are incorrect. Within a product for a family, such as Lophiidae (e.g. monkfish) with conversion factors ranging from 1.2 to over 3.25, live weight conversion factors can vary across species and a country may set a value that is most representative of the most commonly caught species. Live weight conversion factors can also differ with the type of processing technology used, which can change over time and/or vary geographically. These variations in conversion factors for a single family of fish illustrate the kind of confusion and discrepancies that can exist in estimating live weight and how this can lead to misrepresentations. Since operators do not typically

report conversion factors, it remains difficult to evaluate whether discrepancies in live weight estimations are justified or not.

It could also be the case that none of the values are accurate. First, since live weight conversion factors can vary with differences in processing technology, values could become outdated. Second, if there is any tendency to use live weight conversion factors to underrepresent catch, the tendency would be to set lower live weight conversion factors and this could occur simultaneously in multiple countries. Conversion factors near the value of 1 for presentations that involve removing non-trivial amounts of fish mass during processing (e.g., headed and gutted) could indicate that the conversion factors are unrealistic. Finally, there are also substantial data gaps, with over 60% of the most landed species in the EU lacking conversion factor values at the national and EU-level.

Box 3. Non-EU, European Atlantic cod

Non-EU countries have their own conversion factors which also differ from the values set by EU Member States. For example, applying the UK's conversion factor to their landings of fresh, gutted, and headed Atlantic cod results in a reported 1999 t in estimated live weight in contrast with 2236 t when the EU value is applied (Fig. 4). For Norway, there is greater uncertainty because their fisheries authority specifies conversion factors for multiple presentations (right cut, round cut, and earbone off), all of which can be interpreted as "headed". When the EU value is applied, Norway's estimated live weight amounts to 164,834 t, however, when using Norway's values estimated live weight ranges 145,442 –168,712 t.

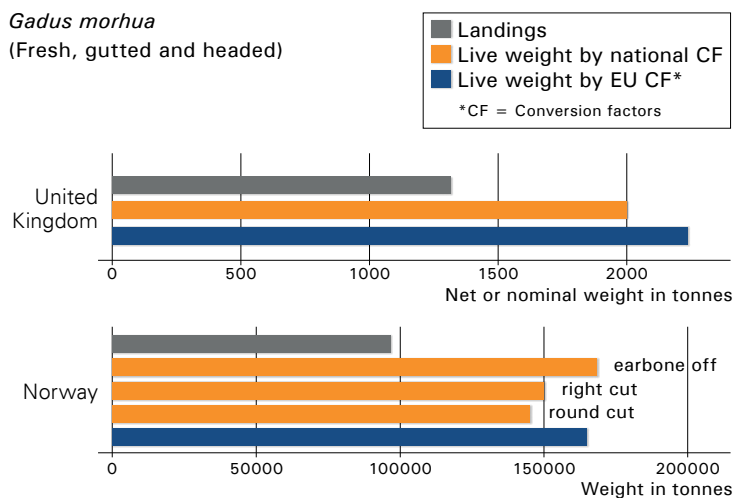


Fig. 4: Landings and estimated live weight using national and EU-wide conversion factors for fresh, gutted and headed Atlantic cod landed by Norway and the United Kingdom.

Trade and EU imports

Estimating the live weight equivalent of catch from trade data requires a different set of conversion factors that will align with trade product definitions. This is important for estimating a country's apparent consumption of seafood and for calculating the live weight equivalent of imports from a non-EU country into the EU.

There are additional challenges with estimating catch based on trade data. First, commodity codes, a standardised set of names and numbers used to classify internationally traded products in the EU and worldwide, often include more than one species, which may differ in size and shape, and therefore, their appropriate live weight conversion factor (Fig. 5). Second, while these codes do specify the presentations and states (i.e. processing method) of a commodity, they may include multiple presentations and states which vary in their live weight conversion factor (Fig. 5). For example, CN 03021400 (Fresh or chilled Atlantic salmon "Salmo salar"

and Danube salmon "Hucho hucho"), includes multiple presentations, requiring an assumption about the dominant presentation. In this case, it is assumed that the majority is traded as head on and gutted, but some is traded as head off and gutted.

Relatedly, the majority of available conversion factor data is for converting landings to live weight. As a result, estimating the live weight equivalent of traded products involves not only resolving the uncertainty in the landed live weight conversion factors, but also identifying the likely mix of species and presentations that fall within a code. The European Market Observatory for Fisheries and Aquaculture Products (EUMOFA) does provide trade code-level conversion factors, but even with the best documentation, a single live weight conversion factor value used to convert trade data into live weight will be unable to capture changes in the species mix or diverse processing methods present under a single product code.

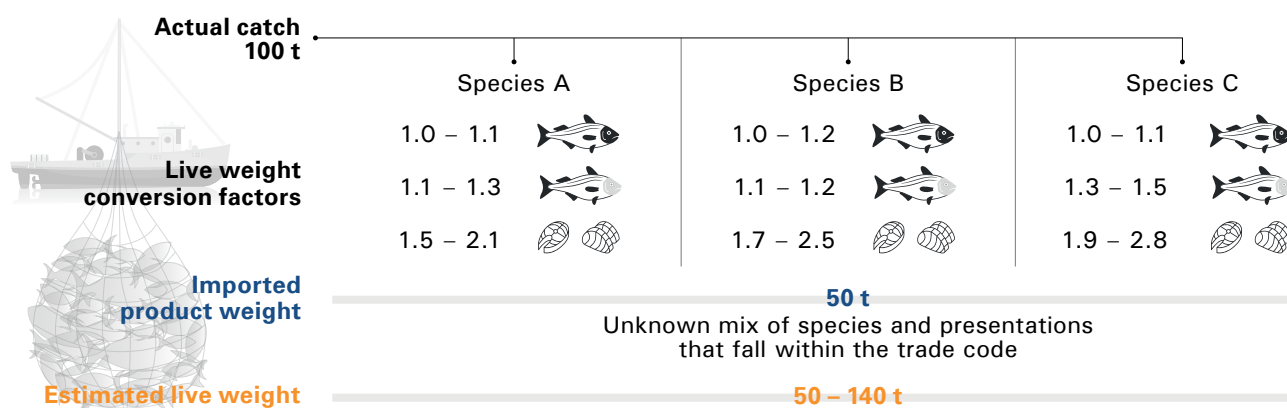


Fig. 5: Illustration of the live weight equivalent calculation based on trade data reported as trade codes that include multiple species and presentations.

Recommendations

Reliable catch data is essential for effective fisheries management and monitoring systems. Fishing logbooks and landing declarations for domestic landings, and catch certificates for imported products, represent an important step for tracking catch volumes. To provide effective fisheries management, accurate quota estimates, and prevent overfishing, the information collected on these administrative documents must be transparent and reliable. This may include clarifying certificate terminology and reporting live weight conversion factors. We therefore recommend that:

First, if the live weights continue to be reported on fishing logbooks, landing declarations, and catch certificates, a field should be added to record the conversion factor applied. In principle, the conversion factor used could be derived when both the estimated live weight and the net (landed) weight are recorded. Given that the conversion factor represents a critical assumption in the calculation, however, providing the conversion factor on these administrative documents would simultaneously make this assumption more transparent and would allow for the live weight calculation to be checked for potential errors.

Second, conversion factors used on domestic products should be defined by the EU for all landed species, presentation, state combinations (i.e. processing method), and the source of established conversion factors should be specified. There are substantial data gaps, including cases where a country indicates that the EU-wide value applies, but no EU-wide value is provided. Reporting the conversion factor data source would enable comparison of values derived from different methods and would contextualize values for fisheries where there may have been changes that affect the conversion factor. Efforts to fill data gaps and update conversion factors should prioritise values for the most commonly landed and high-volume species, presentation, state combinations as these will result in the largest differences in estimated catch.