APPENDIX F.
MILK AND CHEESE TECHNICAL REFERENCE TABLES

The tables bring together the analytical and processing references used in Chapters 15–20. They distinguish published common-hippopotamus milk measurements, established general dairy methods, legal criteria, and arithmetic examples. Values from a few postpartum specimens must never be relabeled as mature-lactation averages, customary dairy specifications, or guaranteed cheese yields.

This appendix is available for download at:

https://greybarnfarm.com/publishing/hippo-dairy

F.1. Published composition and limits of inference

Table F.1. Measured early-postpartum common-hippopotamus milk composition

Days after birth	Protein (%)	Fat (%)	Total sugar (%)	Ash (%)
1	9.56	0.48	4.70	0.67
3	8.06	1.45	4.35	0.67
8	6.39	1.78	4.60	0.73
9	8.16	4.24	4.30	0.72

Source: Henry, Power, Maslanka, Rencken, and Nollman (2022), four samples from one dam after a premature birth. Percentages are as-fed mass fractions. The paper reports total dry matter across samples of 14.38–16.72%; it does not establish mature-lactation means. "Total sugar" is not a lactose-specific determination.

Table F.2. What may and may not be reported as a hippopotamus-milk datum

Item	Evidence status and permissible interpretation
Protein, fat, total sugar, ash	Direct measurements on four early-postpartum specimens; individual observations, not breed or herd benchmarks.
Dry matter	Measured range 14.38–16.72% in the 2022 report; do not assign specific values to days without a verified paired dataset.
Lactose; casein fractions; fatty acids	Not established as a mature-lactation profile by those analyses; require constituent-specific methods.
Calcium; vitamins; rennet response; yield	Do not infer from mineral ash or total protein; obtain new assays or controlled pilot batches.
Historical sample (Gray, 1959)	Published composition is affected by an internal total-solids inconsistency; not a sound production standard.

The older figures reported by Gray (1959)—fat 3.49%, protein 5.30%, lactose 4.32%, and ash 0.80%—sum to 13.91%, while the same account states 11.50% total solids. Retain the discrepancy as a warning about data quality rather than silently reconciling it.

F.2. Sampling and laboratory measurements

A meaningful lot certificate begins with the verified animal or pooled-lot ID, date and time, postpartum stage, calf-access history, treatment eligibility, collection and cooling history, sampling method, laboratory, analytical method, and any departure from normal procedure. A result for a held milk lot cannot substitute for clearance of the individual cow.

Table F.3. Appropriate analytical tools and qualifications

Determination	Example reference or technique	Essential qualification
Representative sampling	ISO 707:2008	Document vessel mixing, aseptic aliquots, sample temperature and chain of custody.
Total solids (milk)	ISO 6731:2010	Reference gravimetric method; result requires a properly handled sample.
Total solids (cheese)	ISO 5534:2004	Obtain cheese moisture by difference: 100% minus solids %.
Fat (liquid milk)	ISO 23318:2022	Gravimetric method; check hippopotamus-milk matrix suitability.
Crude protein	ISO 8968-1:2014	Kjeldahl nitrogen conversion; report factor and nonprotein-nitrogen conventions.
Rapid composition	ISO 9622:2013	Mid-infrared analysis only after species/matrix calibration and controls.
Lactose specifically	ISO 22662:2024 (HPLC)	Different from nonspecific total-sugar assays; validate application.
Casein fractions; fatty acids	Validated fractionation/electrophoresis; GC	Require method, standards, recovery and repeatability suited to the sample.

Method designations identify published methods, not automatic approval for an untested hippopotamus-milk matrix. Confirm each laboratory's scope, controls, quantification limits, and applicable version before relying upon a number for labeling or process design.

F.3. Microbiological parameters and product release

Microbial counts indicate process control; they do not by themselves prove absence of every pathogen. In the EU, raw milk from non-bovine species is assessed under a species category, while the criteria for finished dairy products vary by product, process, and ability to support microbial growth. The dairy must apply the correct product category rather than borrow a cattle somatic-cell limit.

Table F.4. Regulatory reference points and control decisions

Parameter / product	Published EU criterion or control principle
Raw milk, species other than cows	Plate count at 30 °C ≤ 1,500,000 per mL, rolling geometric average over 2 months, at least 2 samples/month.
Non-bovine raw milk for unheated raw-milk products	Plate count at 30 °C ≤ 500,000 per mL under the corresponding 2-month sampling approach.
Cow-specific somatic cells	≤ 400,000/mL applies to cows' milk; not an established hippopotamus-specific threshold.
Drug residues	Veterinary treatment/withdrawal records and relevant maximum residue limits; hold and investigate suspect milk.
Ready-to-eat cheese, L. monocytogenes	Apply Regulation 2073/2005 as amended, including the July 2026 rules: where shelf-life compliance at 100 cfu/g is not demonstrated, "not detected in 25 g" applies to growth-supporting foods.
Other finished-product hazards	Salmonella, coagulase-positive staphylococci, E. coli and hygiene indicators: select the applicable product category, method and sampling plan.

Sources: Regulation (EC) No 853/2004, Annex III, Section IX; Regulation (EC) No 2073/2005 as amended by Regulation (EU) 2024/2895 (applicable from 1 July 2026). These plate-count criteria do not alone establish raw-milk safety or replace a dairy's other operating approvals.

Table F.5. Temperatures supported by European milk-hygiene law

Stage	Criterion and condition
On-farm milk cooling	Immediately to ≤ 8 °C when collected daily; ≤ 6 °C when not collected daily.
During transport	Maintain cold chain; on arrival at destination, milk temperature ≤ 10 °C.
At dairy acceptance	Quickly cool to ≤ 6 °C and hold until processing unless a stated exception applies.
Pasteurization (HTST)	At least 72 °C for 15 s, or equivalent validated effect.
Pasteurization (LTLT)	At least 63 °C for 30 min, or equivalent validated effect.

Important: these are regulatory reference conditions with defined exceptions and validation duties; they are not cheese-vat setpoints. A non-bovine alkaline-phosphatase test may be unsuitable as the sole proof of heat-treatment effectiveness.

F.4. Curd yield and moisture: mass-balance worksheet

Cheese yield is the mass of finished cheese divided by incoming milk mass, usually expressed as a percentage. It depends on incoming casein and fat, their actual retention in curd, whey losses, added salt, and water retained or lost in production and maturation. No single hippopotamus milk-to-cheese yield coefficient applies to every product.

Table F.6. Illustrative 100 kg milk-to-cheese accounting example

Step	Example quantity	Meaning
Milk received	100.00 kg	Chosen starting mass, not a species production figure.
Assumed milk solids	13.00 kg (13.0%)	Hypothetical composition solely for arithmetic.
Assumed recovery into curd	7.15 kg (55% of solids)	Unvalidated retention fraction; remaining solids leave with whey/losses.
Salt retained	0.15 kg	Illustrative added non-water mass.
Final dry matter	7.30 kg	7.15 kg recovered milk solids + 0.15 kg salt.
Finished at 45% moisture	13.27 kg	7.30 ÷ (1 − 0.45); theoretical mass at specified moisture.
Solids not retained	5.85 kg	13.00 − 7.15; not identical to total whey mass.

This example illustrates the calculation, not a typical hippopotamus-cheese yield. Whey mass also contains water; curd handling, evaporation, sampling, and drains require actual batch measurements.

Working formulas: cheese yield (%) = 100 × finished cheese mass ÷ incoming milk mass; finished cheese mass = retained dry matter ÷ (1 − final moisture fraction). In the example, 100 × 13.27 ÷ 100 = 13.27% theoretical yield. Weight per litre cannot be substituted for weight per kilogram without measured milk density.

Table F.7. Sensitivity to moisture at fixed dry matter (7.30 kg)

Final cheese moisture	Calculated finished cheese mass	Calculated yield / 100 kg milk
40%	12.17 kg	12.17%
45%	13.27 kg	13.27%
50%	14.60 kg	14.60%

Only water content changes in this controlled comparison. It does not imply that different cheese types retain identical fat, protein, salt, or solids during real manufacture.

F.5. Cheese-composition indices and process records

Moisture percentage describes water in the whole cheese. Moisture on a fat-free basis (MFFB) and fat in dry matter (FDM) put different formulations on a comparable basis, but neither describes maturation, rind microflora, or sensory quality by itself. Determine moisture and fat on representative, identified samples.

Table F.8. Calculated composition of one illustrative cheese

Quantity	Illustrative measured mass	Calculated result
Whole cheese	10.00 kg	Reference mass
Water	4.20 kg	Moisture = 42.0%
Dry matter	5.80 kg	Dry matter = 58.0%
Fat	2.80 kg	Fat in cheese = 28.0%
Fat in dry matter	2.80 ÷ 5.80	FDM = 48.3%
Moisture in fat-free cheese	4.20 ÷ (10.00 − 2.80)	MFFB = 58.3%

FDM (%) = 100 × fat mass ÷ (cheese mass − water mass). MFFB (%) = 100 × water mass ÷ (cheese mass − fat mass). These are compositional definitions, not validated targets for the regional cheeses described in Chapter 18.

Table F.9. Minimum useful processing and maturation record

Production stage	Record for each traceable cheese lot
Receiving and eligibility	Farm/cow or bulk IDs; treatment release; receipt temperature; tests; intended cheese type.
Coagulation and curd	Culture/coagulant IDs; dosing method; inoculation/setting temperature; pH/time; curd observations.
Drainage and salting	Cutting/cooking schedule; whey removal; press conditions; salt method and mass; curd/cheese weights.
Maturation and release	Room temperature and relative humidity trends; turning; rind checks; deviations; test results; dispatch date.

F.6. Interpreting quality trends and release decisions

A laboratory number needs both a method and a management decision. A raw-milk plate count at 30 °C is an indicator of general microbial load, not a species-by-species pathogen screen. A result must be read alongside sampling representativeness, refrigeration records, animal treatment status, and the processing route for the lot. The two non-bovine count criteria in Table F.4 refer to different intended uses; meeting the less restrictive one cannot qualify a lot for the more restrictive use.

Table F.10. Worked rolling geometric average (illustrative counts)

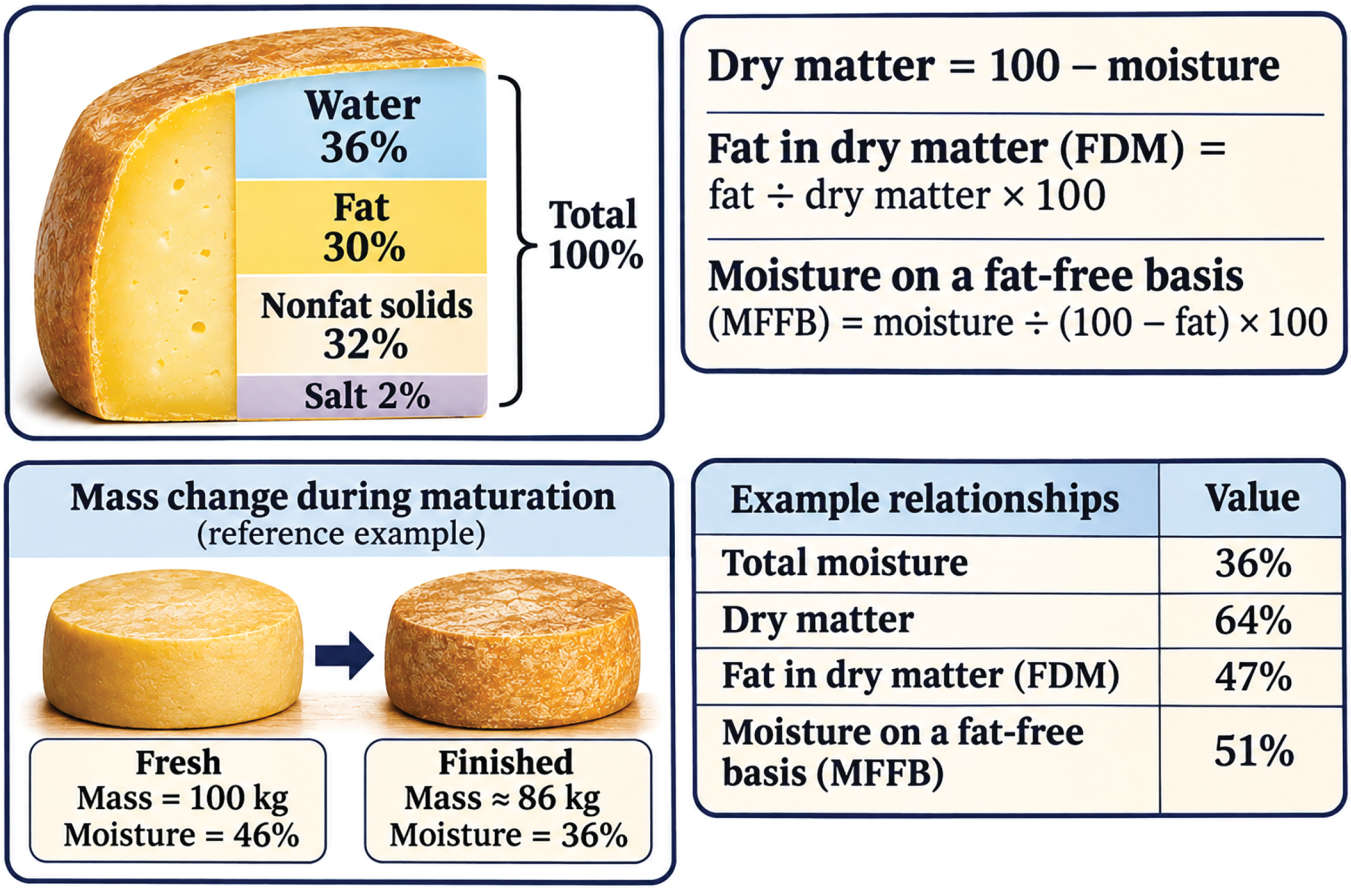
Sample in 2-month period	Plate count at 30 °C	Use in calculation
Month 1, sample 1	400,000/mL	log-scale value 1
Month 1, sample 2	500,000/mL	log-scale value 2
Month 2, sample 1	600,000/mL	log-scale value 3
Month 2, sample 2	700,000/mL	log-scale value 4
Geometric average	approximately 538,000/mL	Fourth root of the four counts multiplied together.

The resulting average is below 1,500,000/mL but above 500,000/mL. In this arithmetic example it would meet the non-bovine general count criterion while failing the more restrictive criterion for manufacture of an unheated raw-milk product. This does not authorize either use: an operator must meet all other legal, hygienic, and approval requirements. An unusual upward trend warrants investigation even where the geometric average remains within a criterion.

Table F.11. Questions recorded before release of a processing lot

Check	Required record or action
Identity and source	Verified cow identities or bulk-lot inputs; provenance; calf-access and treatment status.
Sample validity	Representative sample, date/time, transport conditions, method, laboratory, and result.
Cold-chain review	Farm cooling, road transport, processor reception, and deviations with their disposition.
Process suitability	Cheese or fluid route, validated temperature/process, product-specific pathogen controls.
Disposition	Accept, segregate, hold, reprocess only when lawful and validated, or reject; sign and trace.

These examples join the documentation approach of Chapters 14 and 16 to the product controls discussed in Chapters 17–20. They are forms of reasoning, not new microbiological limits. Sampling, the applicable legal category, and competent-authority requirements govern actual decisions.



Cheese composition and moisture relationships, showing water, fat, retained nonfat solids, and added salt within the finished cheese; the relationship between total moisture, dry matter, fat in dry matter, and moisture on a fat-free basis; and the change in finished mass as water is lost during maturation.

Principal sources: Henry et al. (2022), Zoo Biology, 41, 360–364; Gray (1959), International Zoo Yearbook, 1, 46; ISO 707, 6731, 5534, 23318, 8968-1, 9622, and 22662; International Dairy Federation, Cheese and Varieties: Part II (2021); Regulations (EC) 853/2004 and 2073/2005, as amended. Chapter 17 explains the underlying processes; Chapters 18–20 discuss their application to regional cheeses and the bottled-milk trade.