

Fish Oil in Early Mesopotamia. Some Observations¹

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[The widespread availability of fish in the economic landscape of Southern Mesopotamia favoured the use of fish oil as a fatty substance particularly suitable for the waterproofing of cordage and boats, but also sporadically used in other contexts or for different purposes. Thanks to its easy availability and practical use, fish oil was –to significant different extents– the object of institutional demand over the course of time. A clear connection with boat building can be inferred as recently as the Presargonic period. From this period, the archive of the e-munus offers the example of the circulation of fish oil within a household, involving its majordomo and the producers, the fishermen. From the Ur III period, the provincial archives of Umma and Ĝirsu describe a more complex situation, which involved the activity of fishermen, fish merchants, and merchants as suppliers, on one hand, and officials and shipyard administrators as go-betweens or beneficiaries, on the other.]

Keywords: Mesopotamia, animal fats, fishermen, merchants, boat building.

0. *Premise*

Fish was a pivotal resource in the economy of ancient Southern Mesopotamia. The widespread availability of this natural resource means that it was probably among the principal sources of meat for the average Bronze Age Mesopotamia's inhabitants,² who could also profit from fish for producing by-products not necessarily destined for human consumption. However, economic documents from the Early Bronze Age substantially reflect the perspective of the state and provincial domain, leaving the non-institutional, private sector essentially underrepresented. As a consequence, the availability of information on fish oil in written documents basically depended on its being embedded in institutional contexts. In fact, it may vary from one archive to another, or over the course of the time, regardless of the possible actual diffusion of fish oil in everyday life.

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Abbreviations follow CDLI's list available at https://cdli.ox.ac.uk/wiki/abbreviations_for_assyriology (accessed June 2022). Add: E = Enentarzi's reign; L = Lugalanda's reign; U = Urukagina's reign; AS = Amar-Suena's reign; Š = Šulgi's reign; ŠŠ = Šu-Sin's reign; IS = Ibbi-Sin's reign.

2. Englund 1990: 26; Widell at al. 2013: 96.

Of course, institutional demand (implying external or internal production) and consequent circulation emerging from written documents, point out a need that can only be understood by identifying the uses that fish oil might have had in Early Mesopotamia.

1. *Uses*³

1.1. *Boat building*

Fish oil is particularly attested in connection with boat building and shipyards. An Old Babylonian literary text, the Debate between Copper and Silver, describes the activity of shipbuilders caulking boats and preparing fish oil for use, both eventually leaving traces on their garments:

1. 104: ma₂-GIN₂ ma₂ du₈ i₃-ku₆-da kum₂-ma tug₂ tan₄-na-a nu-du₇

“*Shipbuilders caulking boats, heating up fish oil, with garments not easy to clean*”.⁴

Fish oil and bitumen could be both used in what texts suggest was required for caulking and crafting boats in economic texts dating to the Ur III period.⁵ These texts could also include ropes, wooden elements, reeds, weeds, wool, and hides in the concept of caulking (du₈), suggesting that this term could also point to the more generic act of crafting boats in some instances. In addition, the employment of several fibrous ropes and threads suggest they were sewn plank constructions, at least in this period.⁶

Different kinds of oil, or oil mixtures,⁷ are commonly employed in sealing and waterproofing the cordage inside the hull of sewn boats such as Arabian dhows, in order to prevent rotting,⁸ or they are used to create a protective layer painted on the lower part of the hull below the waterline as antifouling agents and sealant.⁹ Englund¹⁰ specifically refers to the use of fish oil in waterproofing the hulls of dhow-boats sailing in the Persian Gulf. This specific use can be reflected in a Presargonic text from Ġirsu, BIN 8, 537, where a quantity of fish oil is said to be poured on an already-caulked boat.¹¹

3. A concise dossier on this topic will be available at W. Sallaberger (ed.) 2020-2023: *is.MesopOil Project* <https://www.i3-mesop-oil.gwi.uni-muenchen.de>.

4. From the adapted translation by G. Cunningham in ETCSL 5.3.6 (<http://www-etcsl.orient.ox.ac.uk/>).

5. See e.g. CT 7, 31 BM 18390 (undated); CDLB 2020/2 § 2.3 (§ 42/-); SET 272 (§ 42/-).

6. Widell 2009: 159; Laursen–Steinkeller 2017: 108.

7. Note that there are no clear traces of oil mixture in written documents; nevertheless, what texts define as fish oil can actually be a generic label, not necessarily a product exclusively made up from fish fats. For the employment of different oils, together or instead of fish oil in boat building, see § 1.1.1. Vosmer’s hypothesis, that fish oil was mixed with bitumen to improve its adherence to wooden or reed component (Vosmer 2003; Rinaldi apud Vosmer 2003: 54, indicating an optimal weight to weight ratio as 2.5% –fish oil– to 5% –bitumen) was rejected by Connan et al. (2005: 56–57). Yet, Connan et al. (2005: 65 fn 76) question the use of fish oil in ancient boat building on the basis of one single text, ignoring several connections of this commodity with shipyards and the evidence of BIN 8, 537, where fish oil is not simply listed, but clearly employed.

8. Pedersén 2004: 235–236; Vosmer 2011: 416; Laursen–Steinkeller 2017: 108. Steinkeller (ibid.), followed by Borrelli (2021: 14–15), assumes that fish oil was also employed in the stitching process of boat planks.

9. Pedersén 2004; Connan et al. 2005: 57.

10. Englund 1990: 157 fn 426; 235 fn 648.

11. For this text, see further § 2.3.3.

BIN 8, 537o. I 1-4: 7 sila₃ i₃-ku₆ / i₃ dusu / ezem munu₄ gu₇ / ^dNanše-kamo. II 1-3: lugal-ša₃ / šuku₂ ab-ba-ke₄ / iti ezem ^dBa-U₂-kar. I 1-4: mu-ku_x(DU) / **en-ig-gal** / nu-banda₃ / **ma₂** lu-ub₂ **du₈-a**r. II 1-2: ki umum-ma **i₃-de₂** 3

“7 litres of fish oil: is the oil obligation for the malting-eating festival of Nanše, entered by Lugalša(latuku), the fisherman of the sea, in the month of the festival of BaU. Eniggal, the majordomo, poured it on the caulked lub-boat in the umum-place. 3(rd year)”

Although not excluding other uses in different contexts, this information could indeed endorse the use of fish oil as an additional layer applied on an already caulked boat.

Ur III texts may show that the quantities of fish oil employed in boat building are proportional to the capacity of the boats, calculated in gur (=300 litres), with a ratio of around half a litre of fish oil per gur.¹² We can find minor variations in boats with 60 or 70 gur capacity, both requiring 30 litres of fish oil. Differently, the quantity of bitumen varies from 57 to 96.5 kg per gur.¹³

Text	Boat capacity	Dry bitumen	Liquid bitumen	Broken-up bitumen	Other types	Total am. bitumen	Fish oil
TCL 5, 5673 (Š 46-AS 1) Umma	120 gur = 36.000 l	6120 kg	720 l	360 kg	/	6480 kg 720 l	60 l
WMAH 3 (Š 46-AS 1) Ğirsu	70 gur = 21.000 l kas ₄ ma ₂ -lah ₅	4800 kg	350 l	[...]	/	4800+ kg 350 l	30 l
TCL 5, 5673 (Š 46-AS 1) Umma	60 gur = 18.000 l	3930 kg	300 l	262,5 kg	esir ₂ apin [...]	4192,5 kg 300 l	30 l
TCL 5, 5673 (Š 46-AS 1) Umma	30 gur = 9.000 l	2700 kg	150 l	[...]	esir ₂ apin 120 kg	2.820+ kg	15 l
TCL 5, 5673 (Š 46-AS 1) Umma	10 gur = 3.000 l	465 kg	50 l	90 kg	esir ₂ apin 105 kg	660 kg 50 l	5 l
Santag 6, 68 (Š 45) Umma	10 gur = 3.000 l ma ₂ dumu lugal	660 kg	50 l	/	/	660 kg 50 l	5 l

12. Widell 2009: 159. Pedersén notes that sewn boats require a re-treatment with oil every four to six months (2004: 235 with literature). According to him, this would be the reason why Utanapištim stowed away part of the oil for his voyage of indeterminate length upon the floodwaters. However, economic texts do not allow us to determine whether the fish oil yearly allocated for each boat was used at once or not.

13. Widell 2009: 159. Widell stresses that Potts's assumption (Potts 1997: 131) that the amount of bitumen required was inversely proportional to the vessels' carrying capacity is based on several incorrect readings and calculation of the numbers in TCL 5, 5673.

PPAC 5, 167 [...] Ĝirsu	8 gur =2.400 l	24.900 kg	2850 l	/	esir ₂ a-ba-al saĝ 150 kg	25.050 kg 2850 l	180 l (× 45? ma₂)
CT 7, 31 BM 18390 (-) Ĝirsu	<180?> <i>n ma₂ Ma₂-</i> <i>gan^{ki}</i>				esir ₂ luĥ 951.000 l.	951.000 l	1695 l (× 18- 19? ma₂)

Table 1. Bitumen and fish oil in boat building

Most information comes from TCL 5, 5673, from Umma, recording the items withdrawn by a shipyard for the construction of boats of different capacities. WMAH 3, from Ĝirsu, is a running account of the shipyard of the household of the high priestess of BaU, the wife of the provincial governor. The expenditure section reports a shortfall of 30 litres of fish oil for a boat of 70 gur capacity classified as *kas₄ ma₂-lah₅*. PPAC 5, 167 is likely to be a running account of a shipyard of Ĝirsu. It reports 180 litres of fish oil for boats with 8 gur capacity, therefore we can infer it was the fish oil required for about 45 boats of that capacity. CT 7, 31 BM 18390 from Ĝirsu records the items provided by the provincial governor for caulking Magan boats. By considering boats with a capacity of 180 gur, that is, those boats which according to Steinkeller were used in maritime expeditions into the Gulf,¹⁴ the quantity of fish oil suggests 18 or 19 boats (90l × 18 = 1620l; 90l × 19 = 1710l).

Furthermore, the fish oil required for each boat was far less than bitumen, about one tenth of liquid bitumen. The comparison between the items required for the construction of two boats of 10 gur capacity in TLC 5 5673 and those for one boat of 10 gur capacity in Santag 6, 68 shows that it was the quantity of bitumen that was relevant rather than the type, whereas the different characterisations of dry bitumen may have hinted at recycling procedures. As we can see by the following table, except for some wooden elements which can vary, the items required for two boats are exactly double the quantity of those required for one.

Items	TCL 5, 5673 × 2 boats	Santag 6, 68 × 1 boat
esir ₂ had ₂	31 gu ₂	22 gu ₂ =660
esir ₂ gul-gul	6 gu ₂	/
esir ₂ apin	7 gu ₂	/
esir₂ e₂-a	0.1.4 = 100 l	0.0.5 = 50 l
i₃-ku₆	0.0.1 = 10 l	5 sila₃ = 5 l
^{ĝeš} a-ra	12	6
^{ĝeš} a-da	8	4
^{ĝeš} u ₃	30	15
^{ĝeš} eme-sig	90	45
^{ĝeš} mi-ri ₂ -za	100	50
^{ĝeš} me-dim ₂	4	2
^{ĝeš} ma ₂ -gu ₂	8	4
^{ĝeš} murgu ₂	2	1

14. Laursen–Steinkeller 2017: 58, where it is specified that boats of 180 gur capacity were those used in maritime expeditions in the Gulf, mainly to Magan. Note however the existence of larger boats with a capacity of 360 gur in HLC 384 and BPOA 6 37, both from Ĝirsu.

ġeš ^u mbin	16	8
ġeš ^{zi} -gen ₇	2	1
ġeš ^{gi} -muš	6	3
ġeš ^{pisan} sal	10	/
ġeš ^{pa} ġeš ^{ġeš} ġeš ^{diri}	/	3
ġeš ^{gag}	1200	600
ġeš ^{ġiri} ₃	70	35
su ₄ -SAR	2 gu ₂	1 gu ₂
a ₂ -bi	u ₄ 300	u ₄ 150

Table 2. Items and labour employed in boat building

We should note however that fish oil does not always occur among the items destined for boat construction. From the account of the shipyard of the high priestess of BaU in Ur III times (WMAH 3), we can note that not for all the boats listed a quantity of (missing) fish oil is recorded. Similarly in Presargonic times, in DP 483, where fish oil is lacking among the items destined for the boat of one individual.¹⁵ In these cases it is unclear whether the treatment with fish oil for those boats was not a concern of the administration which produced the documents or whether those boats had particular features, tied to their construction methods or final use, whereby the use of fish oil was not necessary.

1.1.1. *Other oil and fat types employed in boat building*

In very few instances, there is attestation of the use of other kinds of oil in connection to boat building:¹⁶

- sesame oil (i₃-ġeš, 10 litres) in MVN 5, 162 (AS 6/iv) from Ġirsu, for caulking the boat of the king (ma₂ dAmar-dSuen lugal du₈-de₃), unclear whether this is in place of fish oil;

- or lard (i₃-šaġ₂, little more than 44 litres) in BPOA 7, 1644 (AS 2/-) from Umma, clearly as substitution for fish oil (mu i₃-ku₆-še₃), among the items¹⁷ destined for the shipyard.

Moreover, SNAT 411 (AS 6/viii) from Umma associates 5 ½ litres of ghee (i₃-nun), 8 ½ litres of sesame oil, 11 litres of fish oil, 100 litres of liquid bitumen, 1500 kg of broken-up bitumen, and at least 6 baskets of something (ġeš^{IL}₂ [...]), with the caulking of a boat, likely of a processional boat.¹⁸ The quantity of bitumen and fish oil are roughly compatible with a boat of 20 gur capacity, and it is unclear about the use of the additional quantity of the other kinds of oils, whether a mixture or separate purposes are meant.

15. The individual, Gala-tur, may be identified with the soldier attested in DP 616 (o. i 6) or with a fisherman. Note that both a freshwater and a sea fisherman are attested with this name.

16. Note that the substitution of fish oil with sesame oil in RA 15, 94 (AS 2/-) is not directly connected with the shipyard or any other destination (see § 3.2.3). In any case, Pedersen reports the use of vegetable oil for waterproofing the cordage (2004: 235).

17. This text also lists vegetable oil, which, however, was destined to the shipyards alongside foodstuff in several texts; see e.g. Santag 6, 104 (AS 1/-).

18. See Huber-Vulliet 2019: 261.

Items	1 boat of 20 l / 2 boats 10 l	SNAT 411
esir ₂ had ₂	31 gu ₂	/
esir ₂ gul-gul	6 gu ₂	50 gu ₂ =1500
esir ₂ apin	7 gu ₂	/
esir₂ e₂-a	0.1.4 = 100 l	0.1.4 = 100 l
i₃-ku₆	0.0.1 = 10 l	0.0.1 1 sila₃ = 11 l
i ₃ -nun	/	5 ½ sila₃ = 5 ½ l
i ₃ -ĝeš	/	8 ½ sila₃ = 8 ½ l
ĝeš ^{IL₂} [...]	/	6+?

Table 3. Employment of additional oils in boat building

1.2. *Other uses*1.2.1. *ĪI.BAR*

Bitumen and other types of fats or oils were used in the construction or repairing of houses and other structures,¹⁹ but not fish oil, the use of which was likely particularly suitable for (sewn?) structures in contact with water.

Indeed, apart from boat building, Ur III documents reports the use of fish oil in connection to a structure defined as ĪI.BAR.

Nisaba 15/2, 367 (ŠS 6/viii) and Nisaba 15/2, 387 (ŠS 6/-) both from Irisaĝrig, record the employment of bitumen and fish oil for the caulking of the ĪI.BAR of the old garden.²⁰

According to the attested capacity for jars of fish oil in this period,²¹ the quantity of employed fish oil in the first text ranges from 30 to 90 litres, while the second text reports 40 litres. A third text, CUSAS 40-2, 548 (ŠS 9/iii) only reports a small amount of bitumen for the caulking of the ĪI.BAR of the pond (tul₂) of the temple of Enki.

	Nisaba 15/2, 367	Nisaba 15/2, 387	CUSAS 40/2, 548
Dry bitumen	29.0.0 esir ₂ had ₂ gur =8700 l	56.1.0 esir ₂ had ₂ šeĝ ₆ -ĝa ₂ gur =16.860 l	3.4.5 esir ₂ had ₂ šeĝ ₆ -ĝa ₂ gur =1190 l
Liquid bitumen	1.4.3 esir ₂ E ₂ .A gur =570 l	esir ₂ E ₂ .A-bi 2.0.2 gur =620 l	esir ₂ E ₂ .A-bi 8 sila ₃ =8 l
Fish oil	3 dug i ₃ -ku ₆ =90-30 l	0.0.4! i ₃ -ku ₆ =40 l	/

Table 4. Bitumen and fish oil for the caulking of a ĪI.BAR

However, it is unclear whether or not these texts are exhaustive, especially the second and the third ones which do not include the quantities of dry bitumen in the caulking process, but rather the quantity of man-days required for obtaining liquid bitumen from dry bitumen.

Finally, BPOA 1, 1652 (undated) from Umma refers to one boat-mat, muru_x(KID.ŠU₂.MA₂), for the ĪI.BAR of the garden of the storehouse (na-kab-tum). Gardens usually spread out along

19. See Heimpel 2009b: 196.

20. The old garden provided timber for the shipyard in CUSAS 40-2, 112 (AS 8/-); CUSAS 40-2, 333 (-/ix); CUSAS 40-2, 1522 (ŠSX/iii). Moreover, it hosted a royal barrack (CUSAS 40-2, 728 (X/iii) r. 3: e₂-gi-na-tum / lugal ša₃ ĝeš^{kiri} gu-la), see Heimpel 2009b: 165.

21. Studies Leichty 392 (undated) reports the presence of jars of fish oil 30, 15 and 10 litres; see § 3.2.1.

watercourses; therefore one can wonder whether *ḪI.BAR* was some particular platform assembled with cordage and in contact with some body of water, hence requiring an additional protective layer.

1.2.2. *Human consumption or body treatment*

Other possible use of fish oil might be tied to human consumption or body treatment.

BCT 2, 124 (Š 3/vii) from Umma apparently attests fish oil as oil allotted to servants (*i₃-ba arad₂*). The last sign of the first entry is however damaged, hence it seems possible to read *i₃-šaḫ₂*, “lard”, already known to be allotted to male and female servants (see e.g. CUSAS 3, 511, o iv 4). Differently, in Santag 6, 165 (AS 6/xii) from Umma, *Ur-Šulpa’e*, very likely the scribe son of *Lugalkugani* (see below § 3), provides one litre of fish oil and a half a litre of vegetable oil to the provincial governor for a certain *Ur-MUŠ*, who is said to be sick (*tu-ra*). The proper use of the oils is however not specified.

1.2.3. *Market ware*

Interestingly, fish oil was also used as market ware in Ur III Umma records. In UTI 4, 2862 (Š 2/-) 20 litres of fish oil are among the commodities sent by the scribe *Ur-Šulpa’e* (for him, see below § 3) to *Madga*, unclear whether to be used to buy bitumen.²² TLC 5, 6046 (AS 4/-) records the capital available to merchants, among them 540 litres of fish oil provided by *Ur-Šulpa’e* and valued at 18 shekels of silver (30:1). The same ratio is also attested for the following years (Ledgers pl. 6 4, AS 5: 120 l: 4 shekels; TLC 5, 6056,²³ AS 5: 120 l: 4 shekels; Ledgers pl. 13 8, AS 6/ii: 60 l: 2 shekels), and therefore can be safely applied to MVN 14, 565 (AS 5/-), where the 540 litres credited to merchants could have also earned 18 shekels as well. AICAAB 1/2 90, 1935-529 (-/iii-viii) from Umma, year unknown, attests to a higher value, 16 litres of fish oil per shekel. Similarly, BPOA 2, 1877 (Š 32/-) from *Ĝirsu* explicitly indicates a ratio of 15 litres per shekel of silver, that is the highest value for fish oil recorded in Ur III times.²⁴

In the same way that they sold fish oil, merchants could also acquire it.

MVN 3, 186 (Š 39/-), from Umma, attests to the allocation of 3600 litres of barley for buying copper and 200 litres of barley for buying fish oil (o. 5: 0.3.2 še *i₃-ku₆-da sa₁₀-a*). Considering an average value of 22 litres per shekel for fish oil and the value of barley reported in that text of 235 litres per shekel,²⁵ it seems likely that the amount of barley was intended for less than 20 litres of fish oil, a minimal amount if compared to the quantities of fish oil circulating in shipyards. Further, the mediation of merchants in acquiring fish oil for institutional purposes can be tacitly implied in Princeton 2, 260 (Š 35/v) from *Ĝirsu*, where the shortfall of various commodities (including 1 ½ litres of fish oil) refers to the running account of a merchant,²⁶ and in BPOA 2, 1877 (Š 32/-), for which see § 3.1.

22. Heimpel 2009a: 39.

23. Also in this case, the available fish oil might have previously been provided by *Ur-Šulpa’e*, occurring here as receiver of part of the lard acquired by the merchant (r. 10-11).

24. See Englund 1990: 208; Englund 2012: 441; Borrelli 2021: 14. Note that the slightly lower value of 16 litres per shekel reported in Englund (2012: 441) is not confirmed by the text AICAAB 1/2, 1935-527 (Š 46/-), which actually refers to lard, but rather by AICAAB 1/2, 1935-529 (see Englund 1990: 208 fn 575).

25. 23 ¼ shekel for 5460 litres of barley (o. 5-6).

26. The title is not specified, but the individual, *Da-da*, can be identified with a merchant (MTBM 324, Š 39/iv). The one responsible for the repayment is *Ur-Šulpa’e*, unclear whether he was a scribe.

In any case, (fish) merchants' capability in affording or exchanging fish and fish by-products (in what we can imagine as a short range context) suggests the existence of a marketplace, where fishermen could carry out trading activities out of the control of the government.²⁷ Accordingly, whenever interested in obtaining fish oil for institutional purposes, a central administration had two possibilities: affording an already finished product or producing it.

2. Institutional demand

As we have seen, bitumen and fish oil were both elements widely employed in boat building. Bitumen was a valued raw material, imported, and indeed texts suggest it was also recycled from old boats or ploughs. This is not true of fish oil – once used, it could not be reused. Therefore, its use would have required a consistent production and, to different extents in the course of time, this production was subject to institutional demand.

2.1. Archaic period

The importance of fish in the everyday life of ancient Mesopotamia is already reflected in the earliest phases of the cuneiform writing, both in economic documents and in the lexical texts, that is, school compositions to learn cuneiform writing. The archaic lexical composition known as Fish List attests to different kinds of fish or processed fish. Moreover, this list likely reports forms of preservation and methods of preparation, as well as the description of fishing gear and means of transportation,²⁸ most of which can be also found in the economic documentation. However, fish oil is not included in the Fish List, but rather in the lexical composition known as the Vessel List. Such a composition has a number of compound signs consisting of the sign for vessel DUG, depicting a jar, inscribed with the signs of the commodities that the vessels were supposed to be filled with,²⁹ among them a sign combination (DUG_b×KU_{6a}) which the Old Babylonian scribes would interpret as fish oil at the beginning of the second millennium BC.

Vessel List (I 47):

Archaic:³⁰ DUG_b×KU_{6a}

Early Dynastic:³¹ DUG×KU₆

Old Babylonian: i₃ ku₆^{i-ku-u2-a}

The corresponding entry in the ED Vessel List is DUG×KU₆, while the OB source SLT 11 reports the sign for oil, i₃, that of fish, ku₆, that is the common graphic rendering for fish oil attested from the Presargonic period onwards, and the Sumerian pronunciation.³²

DUG represented vessels for liquids, and the variants DUG_{b/c} are often employed for butter oil,³³ while KU_{6a} represented fresh fish or generically fish.³⁴

27. Ouyang 2013: 83.

28. Englund 1998: 94.

29. Veldhuis 2014: 77-78.

30. W 20266,2 o. i 9; W 19948,29 o. ii 1; both from Uruk III.

31. SF 64 from Fara; OIP 99, 9 from Abu Salabikh.

32. See Veldhuis 2014: 78; Wagensooner 2020: 22.

33. Englund 1998: 95.

34. Englund 1998: 80.

Outside the lexical corpus, to the best of my knowledge there is only one attestation of DUG_b×KU_{6a}, in an Uruk III text likely from Umma (CUSAS 31, 167 o. II 6) listing various commodities.

We can compare this lonely attestation to the occurrence of fresh fish (KU₆) in the archaic corpus, for a total of 322 attestations in economic documents, and dried fish (SUḪUR) for a total of 252 attestations in economic documents. This data can be further compared to the occurrences of small cattle (UDU) and barley (ŠE), as representative commodities of institutional demand and control.

	Uruk IV	Uruk IV economic	Uruk III	Uruk III economic	Total IV-III	Total economic IV-III
KU ₆	57	56	381	266	438	322
SUḪUR	45	42	280	210	325	252
UDU	97	97	521	449	618	546
ŠE	78	75	1156	1070	1234	1145
DUG _b ×KU ₆	/	/	3	1	3	1

Table 5. Fish oil in the Archaic corpus³⁵

Therefore, regardless of its attestations in the school compositions, the scarce number of attestations in economic documents might betray a low degree of control on the production of fish oil, as well as a low institutional demand in the archaic period.

By considering the main use of fish oil in later sources, this value could be related to the lack of textual information on boats and boat building for this period. Boats of course did exist,³⁶ but it is hard to determine to which extent boat building was under institutional control and whether fish oil was already employed on them.

2.2. Early Dynastic Period I-IIIa

To the best of my knowledge, there is no information on fish oil in the earliest phase of the Early Dynastic Period (ED I/II), while – regardless of the attestations in the Vessel List in the sources from Fara and Abu Salabikh –, DUG×KU₆, or even i₃-ku₆, are not attested elsewhere in ED IIIa documentation.³⁷

In this period, fishermen, boats and boatmen are attested, but we do not have information on boat building nor do we have enough information on fishermen’s activities.

35. Data From CDLI 2022 <https://cdli.ucla.edu/> (accessed June 2022).

36. As for the written sources, the sign ZATU 339 is recognized as the ancestor of the sign for boat (ma₂). Note that so far this sign is only attested in a few economic documents from the Uruk IV period.

37. Note that fish oil is also absent in the section concerning different kinds of vessels for fats and liquids in what we understand as an ancient practical vocabulary: OIP 99, 33+ (= source AA in Civil 2008) o. viii 9-16: šagan i₃ / šagan i₃ ir / šagan i₃-ĝeš / šagan i₃ šah₂ / dug i₃-ĝeš / dug lal₃ / dug ir / gu₂-zi i₃. As we can note, there are attestations of different vessels for animal and vegetable oils, syrups, and resins—therefore not necessarily edible products—but not fish oil.

2.3. Presargonic Period³⁸

Fish oil is better attested in the last phase of Early Dynastic, the Presargonic period, when two terms for fish oil were employed; the expectable i_3 -ku₆ and i_3 ḫab₂, lit. “stinking oil”,³⁹ corresponding to Akkadian *ikūku*. Both terms are indeed attested in the archive of the e-munus, the household of the wife of the ruler in charge tied to temple of BaU, the main goddess of Ĝirsu, which provides information on the activities of the fishermen in the service of the household.

The e-munus relied on two types of fish, freshwater and sea fish. Fishing grounds of freshwater fishermen were canals and ponds scattered in the agricultural landscape under the household’s control and freshwater marshes in its surrounding environs, while Bauer⁴⁰ hypothesises a colony of sea fishermen at the service of the household next to the seashore, which was ca. 40 km away from the e-munus.

2.3.1. Stinking oil and freshwater fishermen

In Presargonic Ĝirsu, stinking oil was undoubtedly produced from fish.⁴¹ In DP 331 (U4) Eniggal, the majordomo of the e-munus, provides the workshop (e_2 ḡeš-kiḡ₂-ti) with fish coming from a facility defined as e-kisala (e_2 ki-sa₁₄-la), to produce stinking oil (i_3 ḫab₂-še₃ e-ak). The fish is defined as being from Udu and of E’igarasu, both known to be freshwater fishermen⁴² and it is quantified in container for fresh fish: sa-ZI.ZI-a, respectively 50 containers by Udu and 76 by E’igarasu.

In a small group of texts, Eniggal provides fish (both sea, brackish, and freshwater fish)⁴³ to the cook Amar-giri to make stinking fish (ku_6 ḫab₂-še₃ e-ak), very likely for human consumption. Indeed, Bauer⁴⁴ assumes that the label ‘stinking fish’ denoted a kind of sauce, similar to the *garum* in Ancient Rome. However, in DP 329 (U3), 248 sa-ZI.ZI-a containers of fish from the e-kisala are not destined for a cook, but rather are brought by Eniggal to the depot of a garden ($\hat{g}anun$ kiri₆), to make stinking fish (ku_6 ḫab₂-še₃ e-ak). Similarly, in DP 330, a copy (sar-ru-am₆) drawn up in the same year, 249 sa-ZI.ZI-a containers of fish from the e-kisala and a no-longer-readable number of containers from the e-munus are brought by Eniggal in the depot of the workshop ($\hat{g}anun$ ḡeš-kiḡ₂-ti) for the preparation of stinking fish. Notwithstanding the difference of one container of fish, it seems plausible that DP 330 reports the same transaction of fish coming from the e-kisala already recorded in DP 329. Accordingly, the $\hat{g}anun$ of the garden and that of the workshop could have been the same depot, implying that the workshop was located in a garden. Moreover, from Ur III Ĝirsu, we know that $\hat{g}anun$ -depots located in gardens were used for storing building materials, such as tree branches, reeds, and also palm by-products in texts from Ur, but no fruit or edible stuff.⁴⁵

38. A concise dossier on the evidence from the e-munus will be available at W. Sallaberger (ed.) 2020-2023: *i3.MesopOil Project* <https://www.i3-mesop-oil.gwi.uni-muenchen.de>.

39. Stinking oil is also listed in the OB composition *ura-ḫubullu* VI, in a section concerning different types of fats (see MSL 11 110 B A3 i 8).

40. Bauer 1998: 550.

41. Civil apud Steinkeller (1981: 27 fn 14); Bauer 1990-1991: 91; Bauer 1998: 550.

42. DP 327 (U4; U₂-du šuku₂), provider of ZI.ZI.ŠE₃; VS 14, 19 (U2; U₂-du šuku₂ a du₁₀-ga); VS 14, 139 (U3) and DP 325 (U3) shows E’igarasu as provider of marsh fish entered in the e-kisala depot; see Greco 2020: 34-35.

43. DP 304: sea and a-DUN fish; DP 307: unspecified; DP 322: freshwater fish; VS 27, 53: sea fish; VS 27, 93: sea fish.

44. Bauer 1998: 550.

45. Greco 2015: 54.

This location could therefore suggest that stinking oil, rather than stinking fish, was implied. In addition, it seems plausible that stinking oil was an alternative denomination for fish oil influenced by the label ‘stinking fish’, which was produced in the same household, although for different purposes and in different locations. In any case, the type of fish for preparing stinking oil was apparently irrelevant; DP 329 specifies that the containers are full of mixed fish (*hi-a*).

As shown by the pisan dub-ba label Nik 1, 275 (U4), sa-ZI.ZI-a would represent the deliveries requested to freshwater fishermen and corresponding to the monthly table fish and fish obligations requested to sea fishermen,⁴⁶ the latter also encompassing fish oil (see below § 2.3.2). This can imply that basically fish oil from freshwater fish was produced in workshops of the e-munus, while that from sea fish was demanded, as a finished product, from the sea fishermen, whose working place was several kilometres away from the household.

Therefore, the split production of stinking oil within the e-munus with freshwater fish and of fish oil with sea fish, instead produced far from the household, might have depended on logistical matters, rather than on the type of fish (freshwater or sea fish) or on specific final destinations. Indeed, we can note that one text (VS 14 64, L5) records three jars of fish oil coming from the field du-sira, thus very likely produced with freshwater fish. In any case, the available little evidence on the production of stinking oil or on the delivery of fish oil from freshwater fish might suggest that the e-munus mostly relied on the regular supply of fish oil by sea fishermen to satisfy its own need.⁴⁷

2.3.2. *Fish oil and sea fishermen*

Sea fish was delivered to the e-munus on several occasions. Table fish (*ku₆ banšur-ra*) was a monthly delivery; besides, sea fishermen were subject to fish obligations (*ku₆ dusu*) on occasion of the festivals of the main gods.⁴⁸ Two texts are particularly enlightening, RTC 33 and DP 294, as they report what was requested to sea fishermen within a year.

The first one dates to the first year of Lugalanda. It specifies how much each sea fisherman had to deliver as monthly table fish and how much as fish obligation for two festivals, the malt-eating and the barley-eating festivals.

46. Bauer 1998: 547 with literature. See, however, BIN 8, 361 (L1), where brackish water fishermen delivery sa-ZI.ZI-a containers for the malt-eating festival of Ningirsu.

47. One can further wonder whether the production of stinking oil in the household was determined by possible occasional lack of fish oil among sea fishermen’s deliveries in a given year. DP 331 dates to the 4th year of reign of URUKAgina, when there is no available information on the supply of fish oil by sea fishermen. However, DP 329 and 330 date to the year before, when fish oil from sea fishermen was available to the household (see below Table 7). Similar considerations can also apply to the delivery of fish oil from the field du-sira by means of a freshwater fisherman in VS 14, 64 dating to L5, when there is no available information on the supply of fish oil by sea fishermen (see Table 7).

48. Bauer 1998: 544.

RTC 33 (L1)

- o. I 1-5: 120 gir^{ku6} / 10 gur₁₀^{ku6} / ku₆ banšur-ra iti-da šuku₂ ab-ba 1-a-kam / 5 tar^{ku6} / 1 gu₂ gur₁₀^{ku6}
 o. II 1-5: 3 gu₂ ubi^{ku6} / 1 sila₃ i₃-ku₆ / 10 ba / ku₆ **dusu ezem munu₄ gu₇-a / šuku₂ ab-ba 1-a-kam**
 r. I 1-6: 5 tar^{ku6} / 1 gu₂ gur₁₀^{ku6} / 3 gu₂ ubi^{ku6} / 10 ba / 5 saĝ si-U.NU / ku₆ dusu ezem še gu₇
 r. II 1-4: šuku₂ ab-ba 1-a-kam / lugal-an-da-nu-ĥun-ĝa₂ / ensi₂ / lagaš^{ki} 1

“120 pig-fish, 10 sickle-fish: is the monthly fish table (requested to) each sea fisherman; 5 stinging fish, 1 talent of sickle-fish, 3 talents of ubi-fish, 1 litre of fish oil, 10 turtles: is the fish obligation of the malt-eating festival (requested to) each sea fisherman; 5 stinging fish 1 talent of sickle-fish, 3 talents of ubi-fish, 10 turtles, 5 threads hanks(?): is the fish obligation of the barley-eating festival (requested to) each sea fisherman. Lugalanda-nuĥuĝa, governor of Lagaš. First (year).”

The local calendar included two ‘malt-eating festivals’, that of Nanše, in the 9th month, and that of Ningirsu in the 10th, and two ‘barley eating festivals’, that of Nanše and that of Ningirsu, both occurring seven months before the corresponding malt-eating festival. RTC 33 does not specify which one, but the extant documentation attests to deliveries of fish oil as obligation in both months, although never in the same year (see Table 7, below). We can note that, unlike fish, fish oil was requested only towards the end of the year, while si-U.NU, likely a type of thread used for making fishing nets and nautical ropes,⁴⁹ was requested for the barley-eating festivals at the beginning of the year. Therefore, the e-munus apparently requested materials for boat building from sea fishermen two times in a year, threads at the beginning⁵⁰ and fish oil at the end.

One can wonder whether the season, rather than the festivals, had played a role in the timing of the request. Indeed, winter could have been the period when the fish types they used for producing fish oil had more fat; a condition which is suitable for the production of oil, on one hand, and unsuitable for the conservation process of the fish, on the other.⁵¹

Three texts from the Ur III period seem to confirm the availability of fish oil towards the end of the year. Nisaba 15/2, 21 (AS 7/ix/10), CUSAS 40-2, 578 (AS 7/ix/8), and CUSAS 40-2, 192 (AS 7/ix/18), from Irisaĝrig, indeed report that a royal messenger was sent to get fish oil in the 9th month.

The second text concerning fish obligations dates to the second year of reign of URUKAgina as king. It specified: dusu gub-ba, that is, “assigned obligation”. Here, there is no mention of festivals and the fish oil requested is tied to the beginning of the year (za₃-mu). According to Bauer,⁵² in this specific context, this temporal information defined the starting point of the deliveries each fisherman had to accomplish. Furthermore, si-U.NU threads are no longer requested, while table fish is no longer a monthly request, but should be delivered five times in a year.

49. Civil 2008: 131.

50. Note that DP 284 (L1) refers to the fish obligation of the second month as “fish obligation of the si-U.NU(-threads)”, o. iii 2: ku₆ dusu si-U.NU-[kam].

51. Englund 1990: 235 fn 648.

52. Bauer 1998: 544.

DP 294 (U2)

- o. I 1-6: 480 ku₆ dar-ra / 600 sumaš^{ku6} / 10 ba / **1 sila₃ i₃-ku₆ / ku₆ dusu za₃-mu-ka / lu₂ 1-a-kam**
 o. II 1-4: 200 ku₆ dar-ra / 160 ku₆ a-de₂ / ku₆ banšur-ra lu₂ 1-a-kam / mu-a a-ra₂ 5-am₆ lu₂ 1-še₃
 o. III 1-4: mu-tum₃ / **dusu gub-ba / šuku₂ ab-ba-ke₄-ne-kam** / URU-KA-gi-na
 r. I 1-3: lugal / lagaš^{ki} e-ne-gub 2

“480 split fish, 600 sumaš-fish, 10 turtles, 1 litre of fish oil: is the fish obligation of the new year for each person; 200 split fish, 160 ‘water-pouring’ fish: is the fish table each person should bring 5 times in the year. It is the obligation set for the sea fishermen. URUKagina, king of Lagaš set for them.”

As noted by Bauer,⁵³ this shift in the demand is not confirmed by the extant economic texts. Nevertheless, it should be noted that the generic description employed in DP 294 for the type of fish requested is reflected in the description of what was expected in texts recording shortfalls already from the reign of Lugalanda; see e.g. DP 282 (L3), DP 280 (U3), DP 281 (U3), where the shortfalls ascribed to fishermen are quantified in terms of split fish (dar-ra), sumaš-fish, ‘water pouring fish’ (a-de₂), turtles, and fish-oil.

Since it was delivered as an already finished product by sea fishermen, the type of fish used for preparing fish oil is unknown. In any case, we can assume that the gamar-fish was a particularly suitable fish type for the production of oil, since it was written with the same sign for oil (NI=i₃^{ku6}), whereas a particularly fat fish could be meant. Among sea fish, gamar-i-zi^{ku6} is attested in VS 27, 60 (U6) recording a fish obligation of the barley-eating festival of Nanše (2nd month), likely in a period when this fish type was still suitable for conservation.

About the quantity, fish obligations specify the quantities requested of one single fisherman in a year. Variations in the quantity of what was then reported in economic documents might have depended on the size of the group of workers headed by each chief fisherman, that is, the one who interacted with the administration. The administration knew how many workers depended on chief fishermen, because it paid them.

Unfortunately, available information on the number of fishermen employed under a chief fisherman and that on deliveries of fish oil from a chief fisherman do not belong to the same year. The size of the groups is however roughly commensurate to the quantity of fish oil a chief fisherman could deliver. See for instance, the case of Nesaĝ, who in Lugalanda’s first year headed a group of 14 individuals and a year later delivered 15 litres of fish oil. The ratio would be of 1 litre of fish oil per fisherman (including the chief fisherman), suggesting it was requested once a year on the occasion of one of the two malt-eating festivals.

53. Bauer 1998: 545. Indeed, it might have been specifically tied to the request of that year or be part of the political narrative of the ruler, who in the reform texts claims to have reduced the abuse on fish depots (Alster 1991: 5-6; Greco 2021a: 101).

Fisherman	Year (Text)⁵⁴	Fish oil	Workers
Lugal-šalatuku	E 2 (DP 283)	1 dug = 20 l	
	E 3 (DP 172)		5+1
	L 1 (DP 191)		11+1
	L 2 (RTC 35)	10 l	
	L 4 (Nik 1, 269)	10 l	
	U 2 (DP 171)		13+1
	U 3 (DP 177)		14+1
	U 4 (TSA 19)		15+1
Nesaĝ	E 2 (DP 283)	1 dug = 20 l	
	E 3 (DP 172)		5+1
	L 1 (DP 191)		14+1
	L 2 (RTC 35)	15 l	
	L 4 (Nik 1, 269)	18 l	
	U 3 (DP 177)		17+1
	U 4 (TSA 19)		13+1
E-menedena	E 2 (DP 283)	1 gur ₄ -gur ₄ = 9 l	
	E 3 (DP 172)		2+1

Table 6. Fishermen groups

The following chart summarises the fish obligations of sea, a-DUN, and brackish water fishermen.⁵⁵ Fish was delivered fresh, split, or salted, while fish oil was quantified in sila₃ (= 1 litre) from Lugalanda onwards, except for Nik 1, 269, where two fishermen deliver respectively 10 litres of fish oil and 1 jar minus two litres, namely 18 litres, considering the capacity attested for jars in this period.⁵⁶ In DP 283, dating to the reign of Enentarzi, fish oil is quantified in dug jars and thick jars (gur₄-gur₄), whose capacity was around 9 litres.⁵⁷ Therefore, in this case, three fishermen provide ca. 50 litres of fish oil in an unspecified moment of the year. As we can note, fish oil could be not reported at all, expected but not reported as shown by DP 279 (L3), and as a consequence, counted as a shortfall to be repaid, as for example in DP 281 (U3). We can also note, that, although they were considered among sea fishermen, a-DUN and brackish water fishermen were not requested to provide fish oil. Deliveries encompassing fish oil could be directed to a warehouse (e₂ niĝ₂-gur₁₁-ra), to a particular storehouse (e₂ ur₃-ra),⁵⁸ or generically to the household (e₂ munus).

54. Note that TSA 19 (U4) records a barley payment occurred in occasion of malt-eating festival of Ningirsu, corresponding to the last fish obligation of the year.

55. Since fish obligations of the barley-eating festivals never report deliveries of fish oil, they have been not included in this chart. Note that VS 25 35 records the shortfall ascribed to sea fishermen for both festivals in L1.

56. According to Powell (1987-1990: 504) 20 sila₃ in Presargonic Ĝirsu. This is clear from RTC 35, where the total section summarizes 25 litres as 1 jar and 5 litres.

57. According to Powell (1987-1990: 506) 9 sila₃, but not stable.

58. Selz (2011: 230) translates e₂ ur₃-ra as “Balkenhaus” interpreting it as a functional building part.

Text	Fish	Fish oil	Fishermen	Occasion	Notes
DP 283 (E2)	fresh	2 dug (2 PN) 1 gur ₄ -gur ₄ (1 PN)	šuku ₂ ab-ba-ke ₄ -ne	/	
VS 25, 35 (L1)	fresh	/	< šuku ₂ ab-ba-ke ₄ -ne >	ezem še gu ₇ ezem munu ₄ gu ₇ ^d Nanše	la ₂ -a ku ₆ dusu-kam
BIN 8, 361 (L1)	split/sa-ZI.ZI-a [...]	/	šuku ₂ a-šeš	ezem munu ₄ gu ₇ ^d Nin-ġir ₂ -su	
RTC 35 (L2)	fresh/water pouring	25 sila ₃ (2 PN)	šuku ₂ ab-ba-ke ₄ -ne (sa šu bad-ra ₂) ⁵⁹	ezem munu ₄ gu ₇ ^d Nanše ⁶⁰	e ₂ ur ₃ -ra e ₂ munus
DP 279 (L3)	fresh/salted	<...> sila ₃	šuku ₂ ab-ba-ke ₄ -ne	ezem munu ₄ gu ₇ ^d Nanše	e ₂ munus
DP 282 (L3)	fresh/split	12 sila ₃ (1 PN)	šuku ₂ ab-ba-ke ₄ -ne	ezem munu ₄ gu ₇ ^d Nanše	ku ₆ la ₂ -a (egir ezem)
Nik 1, 269 (L4)	fresh	1 dug la ₂ 2 sila ₃ (1PN) 10 sila ₃ (1 PN)	šuku ₂ ab-ba-ke ₄ -ne	ezem munu ₄ gu ₇ ^d Nanše ⁶¹	e ₂ munus
VS 25, 29 (L5)	fresh/split	/	šuku ₂ ab-ba	ezem munu ₄ gu ₇ ^d Nanše	
VS 25, 52 (L5)	fresh	/			
RTC 30 (L6)	fresh	7 sila ₃ (1 PN)	šuku ₂ ab-ba	ezem munu ₄ gu ₇ ^d Nanše	iti ezem ab-e ₃ -ka e ₂ munus
RTC 34 (L6)	fresh/split/si- nim	/	šuku ₂ a-DUN	ezem munu ₄ gu ₇ ^d Nin-ġir ₂ -su	PN e-na-šid
DP 285 (U 1.1)	fresh/salted	/	gudu ₄ a-DUN	ezem munu ₄ gu ₇ ^d Nanše	Gala-tur (agargara ab-ba)
DP 293 (U2)	fresh/ salted	/	šuku ₂ ab-ba-ke ₄ -ne	ezem munu ₄ gu ₇ ^d Nin-ġir ₂ -su	a ₂ e ₃ -e ₃ -de ₃ ku ₆ ab su-ga-kam (additional duty)
DP 287 (U2)	fresh	/	<šuku ₂ ab-ba-ke ₄ -ne >	ezem munu ₄ gu ₇ ^d Nanše	e ₂ e ₂ -bar ^d bil ₂ -aga ₃ - mes-ka du ₃ -a
DP 309 (U2)	fresh/split	[...] sila ₃	šuku ₂ ab-ba	ezem munu ₄ gu ₇ ^d Nin-ġir ₂ -su	e ₂ niġ ₂ -gur ₁₁ -ra
Nik 1, 272 (U2)	fresh/split	/	šuku ₂ ab-ba	ezem munu ₄ gu ₇ ^d Nanše	
DP 281 (U3)	fresh/split	6 sila ₃ (1 PN)	šuku ₂ ab-ba-ke ₄ -ne	ezem munu ₄ gu ₇ ^d Nin-ġir ₂ -su	la ₂ -a ku ₆ dusu (3 years) gu ₂ -ne-ne-a e-ne- ġar

59. The sea and a-DUN fishermen of the e-munus are here described through the type of net they used as working tool.

60. This text also mentions the festival of “the barley eating of Nanše (r. III 4: ezem še gu₇), therefore it might encompass the two yearly fish obligations requested to each sea fisherman. Were this the case, we can note the lack of si-U.NU threads among the deliveries.

61. Like RTC 35, also this text mentions the fish obligation of both festivals of Nanše.

DP 280 (U3)	fresh/split	6 sila ₃ (1 PN)	šuku ₂ ab-ba-ke ₄ -ne	ezem munu ₄ gu ₇ ^d Nin-ĝir ₂ -su	la ₂ -a ku ₆ dusu (3 years) gu ₂ -ne-ne-a e-ne- ĝar sar-ru-am ₆
DP 291 (U3)	fresh/split/ salted/water pouring	/	šuku ₂ a-DUN	/	e ₂ munus
DP 301 (U3)	fresh/salted	/	šuku ₂ ab-ba	ezem munu ₄ gu ₇ ^d Nanše	e ₂ -ur ₃ -ra niĝ ₂ -sa-ĥa- ka
TSA 48 (U3)	fresh/salted/si- nim	/	šuku ₂ a-DUN	ezem munu ₄ gu ₇ ^d Nin-ĝir ₂ -su	e ₂ niĝ ₂ -gur ₁₁ -ra
VS 14, 24 (U3)	fresh/split/ salted	24 sila ₃ (2 PN)	šuku ₂ ab-ba-ke ₄ -ne	ezem munu ₄ gu ₇ ^d Nin-ĝir ₂ -su	+LUL-gu e ₃ -a im- ma-kam ⁶² (ku ₆ dar-a a du ₁₀ - ga) e ₂ niĝ ₂ -gur ₁₁ -ra
Amherst 1 (U4)	fresh/split/salted	/	šuku ₂ ab-ba-ke ₄ -ne	ezem munu ₄ gu ₇ ^d Nanše	e ₂ niĝ ₂ -gur ₁₁ -ra
DP 311 (U4)	smoked/salted	/	šuku ₂ <ab-ba>	iti ^d Nin-ĝir ₂ -su an-ta sur-ra-a i ₃ -lah ₅	dusu šumaš ^{ku6} -kam
DP 319 (U4)	fresh/split	/	šuku ₂ a-šeš	iti gu ₄ -ra ₂ bi ₂ - mu ₂ -a; iti ezem ^d Li ₉ -si ₄	
DP 312 (U5)	fresh/split	/	šuku ₂ ab-ba	<...>	e ₂ munus
DP 315 (U6)	fresh/split	/	šuku ₂ ab-ba	iti l l-a til-la-a	
DP 317 (U6)	fresh/split	/	šuku ₂ ab-ba-ke ₄ -ne	<...>	(ku ₆ dar-a a du ₁₀ -ga)
TSA 50 (U6)	fresh/split	/	šuku ₂ ab-ba	<...>	+ maš-da-ri-a-am ₆

Table 7. Fish obligations (ku₆ dusu-kam)2.3.3. *The 'fish oil obligation' (i₃ dusu)*

BIN 8, 357 (U3), already seen in § 1.1, specifically mentions a (fish) oil obligation, i₃ dusu (o ii 2). This text, however, does not describe an additional obligation, but just the entanglement of specific information. Lugal-šalatuku, a well-known sea fisherman, delivers 7 sila of fish oil as an obligation for the festival 'malt-eating' of Nanše (9th) in the month of the festival of BaU (12th month), that is three months later.⁶³ However, the reason why this information was unbundled by an account of fish obligations seems to have been tied to the description of its use. Indeed, as already noted, the text specifies that the oil is poured by Eniggal onto an already-caulked boat.⁶⁴

62. LUL-gu e₃-a im-ma-kam: "it is the restitution/repayment of the last year". See also VS 14, 20 (L1), where sea fishermen repay in silver the shortfalls of unaccomplished obligations.

63. Selz 1993: 574.

64. The boat is defined as ma₂ lu-ub₂, unclear whether it can be understood as "boat of turnips" (cf. Ur III UET 3, 272: ma₂ lu-ub₂^{sar}). In VS 27, 76 ma₂ lu-ub₂ contrasts with ma₂ lugud₂ (short boat) and ma₂-gur₈ (barge). Wooden elements for the construction of this kind of boats were supplied by gardens (VS 27, 76: am-ra, "beams", DP 428: gi-muš, "poles") or forests (VS 27, 32: šu-nir, "standard") under the household control.

The place where the pouring took place is defined as *ki umum*. Selz⁶⁵ supposes a connection with the funerary cult tied to the festival of BaU and this place, which he relates to the activity of wailing women.⁶⁶ According to Jagersma,⁶⁷ however, *ki-ḥulu* is the word denoting a mourning place in Presargonic Ĝirsu. Therefore, one can wonder whether *ki umum* denoted rather a type of workshop⁶⁸ or a sort of shipyard in this very archive. Noteworthy are texts of the e-munus concerning the allocation of timber for boat construction (e.g. VS 27, 76) and the presence of a shipyard of the high priestess of BaU (WMAH 3), wife of the governor in charge, in Ur III Ĝirsu.

2.4. Sargonic Period

From the Sargonic period, some information on fish oil also comes from Ĝirsu, at that time part of the Akkadian empire. The central government basically allowed the ancient city-states to keep home rules, only levying taxes and manpower.⁶⁹ The extant documentation shows that Akkad, the capital of the state, demanded fish, but not fish oil.⁷⁰ Also in this period, it is clear that fish oil was employed in boat construction, as in CT 50, 178, where fish oil (3 jars), dry and liquid bitumen, wooden elements, and ropes are destined for a boat.⁷¹ Boatmen received fish oil as a finished product as shown by ITT 5, 6740, recording an expenditure of fish oil on behalf (*šu ba-ti*) of an overseer of barges (*ugula ma₂-gur₈*). The expenditure is subdivided into three entries; two of them ascribe 4 litres of fish oil each to two *maškim*-officials. A third entry reports just the quantity, 1/3 of litre of fish oil. Because the recorded procedure is classified as expenditure, the *maškim*-officials could have been the final receivers of the fish oil or its original providers. Further providers of fish oil could have been also *enku*s, a sort of fish merchant.⁷² A damaged text (ITT 2, 5836) records the delivery of fish by an *enku*, and a further individual, whose name and delivery are lost in the breaks of the tablet. The delivery of the *enku* includes 10 jars, possibly of fish oil. The circulation of fish oil for institutional purposes was indeed likely centralised (on a provincial level) and issued through local warehouses.⁷³

2.5. Lagaš II period

We have very little information on fish oil from the time of the second dynasty of Lagaš, a period when the territory of Ĝirsu-Lagaš was not yet part of the Ur III empire. We have attestation of fish oil (two jars) likely delivered by a freshwater fisherman (AGGT 388) together with already-

65. Selz 1993: 574. The scholar also wonders a connection between the pouring of fish oil and the offerings for the deads occurring during the festival of BaU. However, it seems plausible that the pouring of oil specifically refers to the treatment of the boat quoted one line before (likely with an adessive case-marker to be reconstructed), rather than to a type of libation not attested elsewhere.

66. For the interpretation of *lu₂ umum* as “Klagesängerin im Totenkult”, see Selz 1995: 60 fn 271.

67. Jagersma 2007: 293.

68. Also Selz (1993: 574) refers to the equation between Sumerian UMUM/DIM₆(=DE₂) and Akkadian *mummu*. The latter can be interpreted as craftman or workshop, see also *bīt mummi* (see CAD M/2, 196-197).

69. Westenholz 1999: 50.

70. See e.g. ITT 1083.

71. Possibly the boat of BaU; see HSS 4, 2 and BM 19976 from Ur III Ĝirsu. Considering a capacity of twenty litres per jar (3 jars=60 l), the quantities of fish oil, as well as that of liquid bitumen (600 l), are suitable for a boat of 120 gur, while the amount of dry bitumen (1080 kg) is too low.

72. Greco 2021a, Greco 2021b, Greco 2022.

73. ITT 2, 5891 records the fish, fish oil and spices (*mun, naga, še-lu₂*) available to the official Ur-e₁₁, whose office might have been tied to a warehouse.

processed fish,⁷⁴ and of one boat loaded, or to be loaded, with fish oil (AGGT 559). This information could hint at a centralised management of the circulation of fish oil, delivered as an already finished product, but issued under institutional control.

2.6. *Ur III period*

From the huge amount of texts coming from the Ur III period, we can untangle valuable information on fish oil, as we have already seen for its use. However, its production remains an elusive matter also for this period, while the impact of state demand is implicitly expressed through the information on the circulation of fish oil in institutional contexts, especially in documents produced by the provincial administrations of Umma and Ĝirsu (see below § 3).

3. *Provincial circulation of fish oil*⁷⁵

In the Ur III period, Umma and Ĝirsu were economically and politically important provinces, which, in general, benefited from a certain degree of freedom from the central government in the local management. Ĝirsu however suffered a more intrusive impact of state officials over fishermen's labour and boat transport (crucially involved in the Gulf routes), while the Umma administration relied on a well-established net of local bureaucrats and fish merchants for the managing of fishermen's labour and the circulation of fish.⁷⁶

Therefore, as expected, we can note differences in the circulation of fish oil, which indeed followed different paths in the two provinces.

3.1. *Fish oil supply to shipyards*

As already seen in § 1.1, for the Ur III period, we can rely on information on boat building directly from texts concerning the running of shipyards, *mar-sa*, a term not attested before.⁷⁷

Documents from this period suggest that fish oil was used in shipyards, but not produced there.

A well-attested provider of fish oil for the shipyards of Umma is the scribe Ur-Šulpa'e son of Lugalkugani, who managed the circulation of several items stored in local warehouses. Indeed, aside from fish oil, Ur-Šulpa'e provides both further building material and foodstuff for the shipyards (Vicino Oriente 81/1, 26, Š 45/-; Santag 6, 104, AS 1/-; BPOA 7, 1644, AS 2/-;⁷⁸ Nik 2, 312, AS 4/-), or just bitumen and fish oil (MVN 16, 664, AS 9/-). The activity of Ur-Šulpa'e might have been started around Š 44.⁷⁹ Indeed before him, a certain Lugal-ezem is attested as provider of fish oil to Lugale-bansa, a scribe of the shipyard⁸⁰ (SAT 2, 178, Š 37/-). Like Ur-Šulpa'e, Lugal-

74. AGGT 388 records the delivery of fish and ducks by 4 individuals, possibly fishermen. The first individual provides fish generically defined as weir fish or split/gutted/beheaded fish, and two jars of fish oil. The occurrence of weir fish (*kun-zi-da*) suggests it was freshwater fish. The second individual provides containers of sea fish, while no information is recorded about the fish measured in containers and delivered by the other two individuals.

75. A concise dossier on this topic will be available at W. Sallaberger (ed.) 2020-2023: *is.MesopOil Project* <https://www.i3-mesop-oil.gwi.uni-muenchen.de>.

76. Greco 2021b: 508; Greco 2022.

77. Alivernini 2013.

78. For this text, see also § 1.1.1.

79. MVN 21, 155 (Š 44).

80. On him, see Alivernini 2013: 88-91. Note also the acquisition of a small quantity of fish oil through merchants in MVN 3, 186 (Š 39/-); see above § 1.2.3.

ezem is also attested as a provider of food for shipyard workers (BPOA 1, 1678, Š 34/xi; SAT 2, 279, Š 41/i).

In Ġirsu the supply of fish oil to shipyards was not entrusted to one single individual. In BPOA 1, 318 (AS 4), the scribe of the shipyard Nammah received more than 30 litres of fish oil from Agi, a merchant⁸¹ who was also involved in the supply of bitumen for the shipyards (SNAT 13, Š 39/-; NABU 2006 30, Š 46/-; MTBM 320, Š 46/-; MTBM 321, AS 2/-; PPAC 5, 71, AS 6/-; PPAC 5, 167, [...]). In Nisaba 33, 974 (AS 4/xi) 20 litres of fish oil provided by a certain Ur-saga, unclear whether a merchant, are directed to the shipyard in the 11th month. The conveyor is a certain Šeššeš, unclear whether he was the enku⁸² or the merchant.⁸³

An earlier text from Ġirsu, BPOA 2, 1877 (Š 32/-), a running account of silver subscribed by saġġa and šabra-administrators, provides further information on the acquisition possibilities of fish oil by scribes of the shipyards. The intermediation of merchants might have been implicit in this document, while the administrators occur as the providers of items for the construction of boats. The value of fish oil is particularly high, 15 litres per shekel.⁸⁴ Part of the silver managed by the saġġa of Ningēšzida was expended for the acquisition of construction materials on behalf of the scribe of the shipyard Lu-Ninšubur,⁸⁵ including 266 litres of fish oil, whose value was 17 shekels, 2/3, and 12 grains. Similarly, part of the silver managed by the saġġa of Šulgi was expended for the acquisition of construction materials on behalf of the scribe of the shipyard Ka'amu,⁸⁶ including 267 litres of fish oil, for a total of almost 18 shekels (o ii 7: ku₃-bi 18 gin₂ la₂ igi 6-ġal₂). Part of the silver managed by the saġġa of Ningirsu was expended for the acquisition of construction materials on behalf of an individual who cannot be identified with a known scribe of the shipyard (Lu₂-^d[...]-ti), among them 188 litres of fish oil obtained for little more than 12 ½ shekels. Finally a further administrator, whose mention is lost, provides elements for boat building to a certain Lugal-lusasa, including 295 litres of fish oil for little less than 20 shekels (ku₃-bi ⅓^{ša} la₂ igi 3-ġal₂). It seems clear that the temple households quoted in this text did not produce fish oil. Moreover, the quantity of fish oil provided by the temple administrators to the scribes of the shipyards is consistent with that provided by Ur-Šulpa'e in Umma. The office of Ur-Šulpa'e can be compared in many aspects to that of Ur-abba son of Bazi, the scribe of the warehouse of Ġirsu, who had a marginal involvement in the circulation of construction materials for the shipyards,⁸⁷ and, as a consequence, in the circulation of fish oil. Ur-abba son of Bazi is however attested (o ii 3') as provider of timber from a forest in MVN 22, 183 [...], a broken text which seems to report the starting capital of an account of the shipyard. The names of the receivers are lost, except for Ur-BaU, likely the scribe of the shipyard.⁸⁸ Among the construction materials, we find 100 litres of fish oil generically provided by fishermen and conveyed by a captain, and 66 litres provided, alongside palm fibres and boat planks, by an individual whose name cannot be entirely read.

81. SAT 1, 88 (AS 7/-), A-gi₄; His actual name might have been Ur-niġar, as shown by his seal: SAT 1, 366 (Š 46/-): Ur-niġar^{ar} dumu Ur-sa₆-ga dam-gar₃.

82. Afo 24, pl. 17, Truro I (Š 36) o. iii 2.

83. MVN 22, 183 [...] o. ii 5', where he occurs as provider of bitumen.

84. See § 1.2.3.

85. Alivernini 2013: 64.

86. Alivernini 2013: 60-62.

87. See Greco 2015: 297.

88. Alivernini 2013: 71-72.

Date (Text)	Shipyards	Receiver	Provider	Fish oil
Umma				
Š 37 (SAT 2, 178)	Umma	Lugale-bansa (scribe of the shipyard)	Lugal-ezem (scribe)	50 l
Š 45 (Vicino Oriente 81/1 26)	Umma	Lusa-izu (scribe of the shipyard) ⁸⁹	Ur-Šulpa'e (scribe)	260 l
AS 1 (Santag 6, 104)	Umma	Niĝ-lagar'e (scribe of the shipyard) ⁹⁰	Ur-Šulpa'e (scribe)	286 l
AS 2 (BPOA 7, 1644)	Umma	Niĝ-lagar'e (scribe of the shipyard)	Ur-Šulpa'e (scribe)	[...]
AS 4 (Nik 2, 312)		Niĝ-lagar'e (scribe of the shipyard)	Ur-Šulpa'e (scribe)	50 l
AS 9 (MVN 16, 664)	Gu'edena	/	Ur-Šulpa'e (scribe)	30 l
Ĝirsu				
Š 32 (BPOA 2, 1877)	Ĝirsu	Lu-Ninšubur (scribe of the shipyard)	saĝĝa Ningeszida	266 l
Š 32 (BPOA 2, 1877)	Ĝirsu	Ka'amu (scribe of the shipyard)	saĝĝa Šulgi	267 l
Š 32 (BPOA 2, 1877)	Ĝirsu	Lu-[...]-ti	saĝĝa Ningirsu	188 l
Š 32 (BPOA 2, 1877)	Ĝirsu	Lugal-lusasa	[...]	295 l
AS 4 (BPOA 1, 318)	Ĝirsu	Nammah (scribe of the shipyard) ⁹¹	Agi (merchant)	+30 l
AS 4/xi (Nisaba 33, 974)	Ĝirsu	Ur-BaU (scribe of the shipyard)	Ur-saga (merchant?) ĝiri ₃ Šeš-šeš	20 l
[...](MVN 22, 183)	Ĝirsu	[...] Ur-BaU (scribe of the shipyard)?	fishermen ĝiri ₃ Ur-Šul (nu-banda ₃) ⁹² Ur- ^d EN.[...]	100 l 66 l

Table 8. Fish oil supply to shipyards

3.2. Who provided the providers?

Provincial archives do not provide information on the ways merchants acquired the products requested by the administration. Thus, information on the circulation of fish oil is practically circumscribed to the supply to its final destinations in Ur III Ĝirsu.

The situation is different in Ur III documents from Umma, where the local managing of fish oil was entrusted to a scribe. Ur-Šulpa'e son of Lugalkugani played a key role in the circulation of fish oil, providing it to merchants (see § 1.2.3), the provincial governor (§ 1.2.2), and scribes of the shipyards (see above § 3.1). Therefore, it is interesting to know how he obtained it.

89. Alivernini 2013: 83.

90. Alivernini 2013: 96.

91. Alivernini 2013: 66-71.

92. See Alivernini 2013: 72.

3.2.1. *Fish merchants*

Ur-Šulpa'e received fish oil from different channels, including enku. Nisaba 6, 34 (AS 6/-), and CDLI P322305 (AS 6/-) a copy, report the running account subscribed by the enku Ur-Utu. The 375 litres of fish oil reported in the capital section will be then expended in two tranches to Ur-Šulpa'e. A running account subscribed by Ur-Utu one year earlier (NYPL 75, AS 5/-),⁹³ reports the expenditure of 135 litres of fish oil on behalf of Ur-Šulpa'e as well (o iii 21-22: 0.2.1 5 sila₃ <i₃> [ku₆] [...] / kišib Ur-^dŠul- [...]). In BPOA 1, 1206 (AS 8/xii), Ur-Utu delivers 169 litres of fish oil to Ur-Šulpa'e, while one year later Ur-Šulpa'e receives 65 litres of fish oil by the enku Lugal-kugani (UTI 5, 3284, AS 9/-). In one case (UCP 9-2-2 122; AS 1), the receipt of 104 litres of fish oil provided by an enku is sealed by the governor, without information on the final destination.⁹⁴

Date (Text)	Receiver	Provider	Fish oil
AS 1 (UCP 9-2-2 122)	governor	Ur-BaU (fish merchant)	104 l
AS 5 (NYPL 75)	Ur-Šulpa'e (scribe)	Ur-Utu (fish merchant)	135 l
AS 6 (Nisaba 6, 34; CDLI P322305)	Ur-Šulpa'e (scribe) 2×kisib	Ur-Utu (fish merchant)	375 l
AS 8/xii (BPOA 1, 1206)	Ur-Šulpa'e (scribe)	Ur-Utu (fish merchant)	169 l
AS 9 (UTI 5, 3284)	Ur-Šulpa'e (scribe)	Lugal-kugani (fish merchant)	65 l

Table 9. Fish merchants' deliveries

As is the case for merchants, texts do not properly specify how fish merchants obtained fish and fish oil; what they report is that they handle huge amounts of state-held fish and fish oil.⁹⁵

SNAT 347 (AS 4/-) records the capital of fish available to one enku, likely Ur-Utu, including 664 litres of fish oil conveyed by Umani and Ur-enuna, who can be scribes or other enku.⁹⁶ Note that in BPOA 6, 1411 (AS 2/-), Ur-Utu seals the document attesting the delivery of a huge amount of fish and 14 jars (dug) of fish oil from Umani and Ur-enuna, by specifying that the terms of the account were set according to the standard regulations.⁹⁷ The quantity of fish oil ranges from a maximum of 420 litres (jar capacity: 30) to a minimum of 140 (jar capacity: 10). In Studies Leichty 392 (undated), 9 jars of fish oil from Kamari (4 with a capacity of 30l, 2 of 15l, 3 of 10l; a total of 180l) are fraudulently taken by Umma fishermen and likely sold to a fish merchant of Ġirsu.⁹⁸ In Ġirsu the activity of fish merchants is barely attested, so that we can infer that the fish merchant who acquired the stolen oil acted for his own profit, being able to find buyers in an alleged marketplace.⁹⁹

93. The expression 'niġ₂-ka₉ aka nam-enku' could be lost in the breaks at the bottom of the tablet (rev. iii, 2'-3'): [niġ₂-ka₉ aka nam-ZAG].HA / [Ur]-^dUtu-ka).

94. See also Santag 6, 165 involving Ur-Šulpa'e in § 1.2.2.

95. Greco 2022: 199.

96. The seal of Ur-enuna (MVN 5, 5; Š 39) does not specify the professional title, but just his affiliation to Umani. Umani was the name of an enku (*Treasuring the word* S 84, Š 33-38) and a scribe (NYPL 109, Š 38/-).

97. For this interpretation of ka-ga (=in-) ge-na, see Widell 2008: 218.

98. For this text, see Sigrist 2006: 391-392. Note that the list of jars follows the verb (in-na-šum₂), unlike the quantities of fish surely given to the fish merchant.

99. Greco 2021b: 506-507.

3.2.2. *Fishermen*

Ur-Šulpa'e could also obtain fish oil directly from fishermen. In UTI 3, 1984 (ŠS 2/-), Ur-Šulpa'e receives fish oil from Šešpada, a fisherman of Šara, the main god of Umma. The fish oil is labelled as freshwater (100 litres) and KU₆.DA.PA.KAS₄ (39 litres). Similarly, in UTI 5, 3304 (AS 9/-) fish oil labelled as freshwater ([...]) and KU₆.DA.PA.KAS₄ (11+ litres) is delivered to Ur-Šulpa'e without any mediation of chief fishermen.

CUSAS 40-2 527 (AS 9-ŠS 2) seems to record the movements of goods in a given span of time referring to a scribe, possibly Ur-Šulpa'e,¹⁰⁰ or a warehouse. Apart from fruit and bitumen, a no-longer-readable quantity of fish oil is delivered by the fisherman Ur-Suen. Ur-Suen was a well-known fisherman of the province,¹⁰¹ who in AS 4 (AOS 32 C 16) and AS 5 (Ontario 2, 218)¹⁰² mediated the silver payments for (fishermen) KU₆.DA.PA.KAS₄.

We can note that the label KU₆.DA.PA.KAS₄¹⁰³ exclusively refers to a group of fishermen¹⁰⁴ or to supplies of fish oil, and never occurs in connection to fish or fish oil expended. Accordingly, we can wonder whether KU₆.DA.PA.KAS₄ denoted individuals purposely employed¹⁰⁵ in specific activities (ku₆-da PA.KAS₄?) or workshops (KU₆.DA.PA.KAS₄?) for producing fish oil within the main households (Šara, Suen) or district (Apišal).¹⁰⁶ Therefore, the differentiation might have concerned oil independently produced by freshwater fishermen, and requested as an already-finished product (the largest quantities), and those produced in institutional workshops, as it was the case in Presargonic Ġirsu.

100. The listed goods are comparable with those provided by this scribe to merchants in TCL 5, 6056.

101. Englund 1990: 195; Borrelli 2021: 29; Greco 2022: 200-201.

102. In this text the fishermen are specifically tied to ^dSuen (o. 1).

103. The label KU₆.DA.PA.KAS₄ is unclear; a linear interpretation as (fishermen) “of the fish of the maškim official(s)” is hampered by the split rendering of a genitive construction. One may wonder whether some construction like PN ku₆-da tuš (“settled by the fish(ing)”) can be involved, whereas PA.KAS₄ should denote a participle. However, to the best of my knowledge, PA.KAS₄ (=maškim) is never attested as a verb in 3rd millennium sources. Note that a connection with the attestation from Sargonic Ġirsu of maškim officials in connection to fish oil (ITT 5, 6740 in § 2.4) is appealing, but unfounded. Moreover it is unclear whether this label could somehow relate to the professional title KU₆.DA.KAS₄ of Lugal-itida son of Ur-susu, the individual who seals the tablet recording the allocation of fish for the regular offering of Šara coming from the field of Šara (CDLI P420920). Outside Umma, there is attestation of KU₆.DA.KAS₄ in MVN 6, 338 from Ġirsu in connection to a group of workers contrasting with a group of state dependents (eren₂ [...]).

104. See Borrelli 2021: 14-15, where all the currently available evidence is collected; add BPOA 14, 430 BM 26214 [...], quoting KU₆.DA.PA.KAS₄ of Šulgi (o. ii 5) among the personnel of the god Šara; see Huber-Vulliet 2019, 257 fn 1230, 430-432. From Orient 21, 6 (undated), we can infer the presence of 20 fishermen KU₆.DA.PA.KAS₄ employed in threshing barley under the supervision of the fisherman Šešpada. The other fishermen involved (Lugal-saga and Ur-Suen) are also under the supervision of Šešpada, but not included in the group of KU₆.DA.PA.KAS₄ (o. ii 25-r. i1); note however the involvement of Lugal-saga in the management of the silver repayment due by KU₆.DA.PA.KAS₄ fishermen already in Š 44 (AICAAB ¼ Bod. S 476 o. 1-3) and that of Ur-Suen in AOS 32 C16 (AS 4/-). Differently, BPOA 14, 430 BM 26214 [...] does not mention fishermen responsible for the silver ascribed to the KU₆.DA.PA.KAS₄.

105. BPOA 2, 2628 (AS 9/vi) attests the acquisition by Šešpada of one individual among the KU₆.DA.PA.KAS₄ of Šara starting from the 6th month (Sept/Oct) of that year under the supervision of a certain Lu-balasaga, who also occurs as supervisor of fishermen of the governor's soldiers in UTI 3, 1801 (ŠS 1/xi). Traces of the acquisition recorded in BPOA 2, 2628 are also in AnOr 7, 374 [...] o. iii 19'-21', however, without any mention of a supervisor.

106. Borrelli 2021: 14-15.

3.2.3. *Fishermen's labour: man-days and fish oil*

In documents from Ur III Umma, fish deliveries can explicitly derive from fishermen's labour ($a_2 \text{ šuku}_2$).¹⁰⁷ CDLI P341989 (ŠS 2/-) includes fish oil (42 litres), alongside fish caught or processed, in what is defined as a delivery derived from fishermen's labour ($a_2 \text{ šuku}_2$) conveyed by Ur-BaU, very likely the son of Da'aga, whose duties encompassed the management of fishermen and sesame farmers' labour.¹⁰⁸ In this frame, we should consider the information reported in RA 15, 94 (AS 2/-), where fish oil (29,5 litres) and sesame oil in place of fish oil (20 litres) are delivered by Ur-BaU to Ur-Šulpa'e; indeed this text does not focus on the final destination of the oils, but basically describes the entry of products obtained through institutional labour into a warehouse. Nevertheless, the connection between fish oil and fishermen's labour requires further attention.

From the running accounts of fishermen's labour, it is clear that the amounts of fish oil always occur as an already-finished product, that is, no man-days are counted or allocated for its production. AION 64 (ŠS 8/-) is a running account of fishermen's labour subscribed by Lugal-niĝlagar'e, a scribe of salt and spices (*dub-sar mun-gazi*), who managed the expenditure for the provisions to Nippur, the holy city.¹⁰⁹ The starting capital consists of an amount of man-days and a quantity of fish oil. While we can follow the expenditure of man-days for catching and processing the fish allocated to Nippur,¹¹⁰ no information is recorded on the destination of fish oil. The balance section reports the number of man-days left and the same quantity of fish oil as the starting capital (135 litres); and this, because fish oil was not included among the commodities of the firstling provision. L'uomo 49 (ŠS 3/-) is a running account of fishermen's labour subscribed by Ur-BaU, likely the son of Da'aga. The starting capital consists of a remainder of fish oil of the previous year (76 litres) plus that of the current year (32 litres), and a number of man-days. The fish oil is allocated to a shipyard (ca. 10 litres) or credited to Ur-e'e (ca. 83 litres). The balance section separately reports the quantity of fish oil (ca. 14 litres) and man-days left.

Finally, commons.wikimedia.org 8112015.jpg (CDLI P512831) is a running account of fishermen's labour, whose subscriber and date are lost. The photo of the obverse is not available; nevertheless we can note that the quantity of fish oil is not related to the labour expended. Also in this case, the balance section distinguishes between labour and fish oil expended (ca. 29 litres) or left (ca. 181 litres).

107. UTI 4, 2417 (AS 1/-), from the fisherman Basaga; Princeton 1, 531 (AS 2/-), from the fisherman Badaga.

108. On him, see Greco 2022: 195-199; Paoletti (2022).

109. See Greco 2021a: 111-112.

110. Compare the quantities of rodents ($2 \frac{1}{2}$) and ravens ($5/6$) reported here and those reported in Kyoto 19 (AS 5/-) as allocation to Enlil (rodents $3 \frac{1}{2}$; raven $5/6$) and SAT 2, 350 (Š 44/-) as allocation to the boat of firstling (rodents /; raven $5/6$), both provided by Ur-Šulpa'e, likely the son of Lugal-kugani.

niĝ₂-kas₇ aka a₂ šuku₂

Text (subscriber)	Capital	Expenditure	Balance
AION 64, 41 (ŠŠ 2/-) Lugal-niĝlagar'e	135 l fish oil	/	135 l fish oil
	6270 ĝuruš u ₄ 1-še ₃	fish for the firstling provision (nesaĝ)	1087 ½ ĝuruš u ₄ 1-še ₃
L'uomo 49 (ŠŠ 3/i/3) Ur-BaU	108 l fish oil	[...] shipyard 83,5 l Ure'e	14,5 l fish oil
	18290 ĝuruš u ₄ 1-še ₃	catching/processing fish	319 1/3 ĝuruš u ₄ 1-še ₃
CDLI P512831 [...]	...	28 l+ to Ur-Šulpa'e	181, 5 l fish oil
	...	allocated to scribes (Lugal-niĝlagar'e, Ur-BaU, others)	5773,5 ĝuruš u ₄ 1-še ₃

Table 10. Accounts of fishermen's labour

As we can note, in all these attestations, fish oil was considered as an already-finished product. Fishermen's labour consisted of man-days, destined for fishing and processing activities from which state-held fish derived, plus fish oil, considered as a finished product that the fishermen had to deliver, as in the case of sea fishermen in the Presargonic e-munus.

This is further cleared by, Babyl. 8, Pupil 21, which records the shortfalls of man-days and fish oil ascribed to two fishermen, Badaga and Amar-isin, for two years Š 45-46 (69,5l and 60l). Interestingly, Ur-BaU occurs as responsible for the repayment of the shortfall (Ur-^dBa-U₂-ke₄ sa₂ di-dam; lit. has to fix it) in this text,¹¹¹ while Da'aga himself seals the tablet.

The involvement of Ur-BaU in the managing of labour and fish oil for institutional purposes can be further highlighted by the following texts. Nisaba 24, 13 (AS 6/-)¹¹² records shortfalls of outstanding assets (la₂-NI sila-ta e₃-a), and ascribes to Ur-BaU a "remnant levied on (his) account" (si-i₃-tum niĝ₂-kas₇ aka-e ba-ab-il₂) of man-days (13.787), fish oil (217 litres), and sesame (72 litres) for the year AS 3. He is also among the ones entitled to make withdrawals (lu₂ niĝ₂-dab₅-ba-ke₄-ne) in Nisaba 26, 94 (AS 6), where a shortfall of man-days (10.800+), and fish oil (214 litres) is ascribed to him, and in SNAT 378 (AS 7),¹¹³ where again a shortfall of man-days (14.315,8), sesame (223,3 litres) and fish oil (3016 litres) are ascribed to him. These procedures can be compared with the withdrawals of the throne-bearer Basaga in Š 46. Indeed, Nisaba 11, 14 (Š 46/-), collecting the shortfalls of the ones entitled to make withdrawals (kišib la₂-NI lu₂ niĝ₂-dab₅-ba-ke₄-ne), ascribes to him different types of bitumen and more than 20 litres of fish oil. The same individual is attested in Santag 6, 133 (AS 4), recording the shortfalls repaid of individuals entitled to make withdraws (la₂-NI su-ga lu₂ niĝ₂-dab₅-ba-ke₄-ne), in connection to the same quantity of bitumen and 25 litres of fish oil.¹¹⁴ We can note that the

111. This text can also be compared to SAT 2, 535 (Š 47/-) and Santag 6 80 (Š 47/-), recording the repayment for the shortfall of fishermen's labour of Badaga and Amar-isin respectively, there acting as conveyor of the silver delivered by Ur-BaU on behalf of Da'aga. However, these shortfalls do not mention fish oil.

112. Nisaba 26, 104 almost reports the same text.

113. We can note, in AS 7 both the quantities of sesame and fish oil are much larger than those of the preceding years, while the quantity of man-days is roughly consistent.

114. The quantity he paid 6 years later shows that no interest was applied to this procedure.

withdrawal of the throne-bearer was very likely finalised to boat building,¹¹⁵ unclear whether in a private or royal context, while that of Ur-BaU to the institutional management of labour and specific products.

Text	Official	Man-days	Fish oil	Other products
Nisaba 24, 13 (AS 6) la ₂ -NI sila-ta e ₃ -a	Ur-BaU (AS 3)	13.787	217 l	72 l sesame
Nisaba 26,94 (AS 6) la ₂ -NI lu ₂ niĝ ₂ -dab ₅ -ba-ke ₄ -ne	Ur-BaU	10.800+	214 l	/
SNAT 378 (AS 7) la ₂ -NI lu ₂ niĝ ₂ -dab ₅ -ba-ke ₄ -ne	Ur-BaU	14.315,8	3016 l	223,3 sesame
cf.				
Nisaba 11, 14 (Š 46) la ₂ -NI lu ₂ niĝ ₂ -dab ₅ -ba-ke ₄ -ne	Basaga throne-bearer	/	20+ l	1320 kg dry bitumen 10 l liquid bitumen
Santag 6, 133 (AS 4) la ₂ -NI su-ga lu ₂ niĝ ₂ -dab ₅ -ba-ke ₄ -ne	Basaga throne-bearer	/	25 l	1320 kg dry bitumen 10 l liquid bitumen

Table 11. Withdrawals of man-days, fish oil and other products

In Ĝirsu, the management of fishermen's labour was entrusted to captains rather than to scribes,¹¹⁶ and indeed, MVN 22, 183 [...] attests to the involvement of a captain (Ur-Šul) in the deliveries of fish oil supplied by fishermen to scribes of the shipyard (see above § 3.1).

3.2.4. Fish oil from fields

As we have seen, Ur III documents are completely elusive about the production of fish oil and the running of relevant facilities.

As it was the case of Presargonic Ĝirsu, where the production of stinking oil took place in a workshop located in a garden, it seems plausible that similar workshops were interspersed in the agricultural landscape in Ur III times. Already in Presargonic times, a text from Nippur (TMH 5, 118) records amounts of fish and one jar of fish oil coming from a field whose name is not fully readable. The Old Akkadian text of unclear provenance MAD 4, 140 refers to barley from the field a-ša₃ i₃-ku₆ ^dĜeštin-an-ka. This field name could be recalled by the occurrence of two plots associated with shrines of Ĝeštinana and indicated as a-ša₃ i₃-ku₆ in Ur III Umma (UTI 5, 3493 o ii 2-5;¹¹⁷ o iii 14-15¹¹⁸). Other references to 'fish oil fields' in Umma are in SNAT 364 (AS 6/-), Nisaba 31/2 12 (ŠS 1/-), and SNAT 508 (ŠS 6/-), while references to fish oil from Kamari do not specifically mention fields (Studies Leichty 392, undated). In any case, none of these texts focus on fish oil production and the only field names do not provide evidence for a production under provincial control. References to 'fish oil fields' could rather be contextual definitions hinting at the places where workshops for the fish oil production were located, regardless whether this was the result of institutional or independent activities.

115. Note that the quantity of dry bitumen hints at a 20-litre boat, while that of liquid bitumen is too low and that of fish oil too high.

116. See Greco 2021b: 507-508.

117. ^dĜeštin-an-na e₂-bar-ZA, alongside the plot of ^dGu-la i₇ sa₁₄-la, both in Ĥar-da-hi^{ki}.

118. ^dĜeštin-an-na ^dAšnan, alongside the plot of ^dNin-du₆-ZUM-mu₂-a.

References to the production of fish oil in the agricultural landscape of Ur III Ĝirsu are indirectly provided by a late text from Ur, UET 3, 1312 (IS 8/x), which reports entries (to be yet compiled) concerning the quantities of fish oil expected by ox-drivers from Lagaš in the 10th month. The date of this text is interesting; the month falls in the period suitable for fish oil production, the year indicates a period when Ĝirsu-Lagaš is supposed to have been already captured and destroyed by the Elamites. Indeed, in IS 8 Ur already suffered from the shortage of barley due to the loss of the Umma and Ĝirsu province,¹¹⁹ and the request of fish oil might have been a consequence of the economic crisis affecting also the shipbuilding sector. One can wonder whether, as the shortage of barley prevented its use as fodder,¹²⁰ the increased price for foodstuffs, including fish, might have affected the availability of fish oil.

4. *Final Remarks*

Fish oil was mostly independently produced by fishermen, who, once they had accomplished the fixed obligations towards the state, were theoretically free to market that product. The buyers may have been individuals who privately tackled the maintenance of their boats, other fishermen, merchants or specifically fish merchants. Once entered into institutional control, fish oil was mostly issued through local warehouses or *via* merchants to shipyards, where it was used in boat building, or to merchants in return for silver. Sporadic uses are attested in connection with structures likely to be in contact with water (HI.BAR), possibly with the same purpose as in boat construction, or to ill individuals. Oil from fish was also produced in institutional contexts, although it cannot be considered a widespread practice.

The most suitable period for fish oil production was probably in winter, when the fish types they extracted oil from had likely a higher fat rate, but it was stored and issued during the whole year. No information is available on the fish types used for producing fish oil, nor does the selection of fish types seem to have been a crucial aspect of its production or final employment. Indeed, a particular feature is that fish oil is always attested without any characterisation on the derivation and quality in third millennium documents, whereas the information we can find on it exclusively concerns the administrative provenance. Paradoxically, one of the most diversified and nuanced natural resources, fish, yielded one indistinct by-product in the eyes of the ancient scribes and bureaucrats.

5. *References*

ALIVERNINI, S. 2013. *La Struttura amministrativa del mar-sa nella Documentazione della III Dinastia di Ur*. Pisa/Rome.

ALSTER, B. 1991. "Contributions to the Sumerian Lexicon". *Revue d'Assyriologie et d'Archéologie Orientale* 85, 1-11.

BAUER, J. 1990-1991. "Altsumerische Wirtschaftsurkunden in Leningrad". *Archiv für Orient-forschungen* 36-37, 76-91.

119. Sallaberger 1999: 174-176; D'Agostino-Pomponio (forthcoming).

120. Gomi 1984: 212.

- 1998. “Der Vorsargonische Abschnitt der Mesopotamischen Geschichte”. In P. Attinger, M. Wäfler (eds) *Mesopotamien. Späturuk-Zeit und Frühdynastische Zeit. Orbis Biblicus et Orientalis* 160/1, 429-585. Freiburg/Göttingen.
- BORRELLI, N. 2021. “Fisheries in Ur III Southern Mesopotamia”. *Annali, Sezione Orientale* 81, 3-38.
- CIVIL, M. 2008. *The Early Dynastic Practical Vocabulary A (Archaic HAR-ra A)*. *Archivi Reali di Ebla. Studi* 4. Rome.
- CONNAN, J. et al. 2005. “A Comparative Geochemical Study of Bituminous Boat Remains from H3, As-Sabiyah (Kuwait), and RJ-2, Ra’s al-Jinz (Oman)”. *Arabian Archeology and Epigraphy* 16, 21-66.
- D’AGOSTINO, F. and POMPONIO, F. (forthcoming) “La storia della Terza dinastia di Ur”. In F. Pomponio (ed.), *Il regno della Terza Dinastia di Ur, Studi Semitici* NS 25. Rome.
- ENGLUND, R. 1990. *Organisation und Verwaltung der Ur-III Fischerei. Berliner Beiträge zum Vorder Oriens* 10, Berlin.
- 1998. “Texts from the Uruk Period”. In P. Attinger, M. Wäfler (eds) *Mesopotamien. Späturuk-Zeit und Frühdynastische Zeit. Orbis Biblicus et Orientalis* 160/1, 15-233. Freiburg/Göttingen.
- 2012. “Equivalency Values and the Command of The Ur III period Mesopotamia”. In J. Papadoulos, G. Urton (eds) *The Construction of Value in the Ancient World*, 427-458. Los Angeles.
- GOMI, T. 1984. “On the Critical Economic Situation at Ur Early in the Reign of Ibbisin”. *Journal of Cuneiform Studies* 36, 211-239.
- GRECO, A. 2015. *Garden Administration in the Province of Ĝirsu during the Neo-Sumerian Period. Biblioteca del Próximo Oriente Antiguo* 12. Madrid.
- 2021a. “Neglected Source of Prosperity. Marsh resources and the role of the enku in Third Millennium Mesopotamia”. In P. Notizia, N. Rositani, L. Verderame (eds) *“Nisaba za₃-mi₂”. Studies in Honor of Francesco Pomponio, dubsar* 19, 95-116. Münster.
- 2021b. “Whips and boats. On hunters and fishermen in Third Millennium BC Southern Mesopotamia”. *Archiv Orientalní* 89, 483-512.
- 2022. “Some Considerations on Workers and Officials involved in the Circulation of Fish in the Ur III Umma province”. In C. Coppini, G. Cyrus, H. Golestaneh, (eds) *Bridging the Gap: Disciplines, Times, and Spaces in Dialogue. Volume 3: Sessions 4 and 6 from the Conference Broadening Horizons 6 held at the Freie Universität Berlin, 24–28 June 2019*, 193-206. Oxford.
- HEIMPEL, W. 2009a. “The Location of Madga”. *Journal of Cuneiform Studies* 61, 25-61.
- 2009b. *Workers and Construction Works at Garšana. Cornell University Studies in Assyriology and Sumerology* 5, Bethesda.
- HOMÉS-FREDERICQ, D. 1980-1983. “Lampe”. *Reallexikon der Assyriologie und Vorderasiatischen Archäologie* 6, 460-463.
- HUBER-VULLIET, F. 2019. *Le Personnel Cultuel à l’Époque Néo-sumérienne (ca. 2160-2003 av. J-C.)*. *Biblioteca del Próximo Oriente Antiguo* 14, Madrid.
- JAGERSMA, B. 2007. “The Calendar of the Funerary Cult in Ancient Lagash”. *Bibliotheca Orientalis* 64, 289-307.
- LAURSEN S. and Steinkeller P. 2017. *Babylonia, the Gulf Region and the Indus*. Winona Lake.
- PAOLETTI, P. (2022) “Ur-BaU”. In Sallaberger W. (ed.) 2020-2023. *i3.MesopOil Project. Vegetable Oils And Animal Fats In Early Urban Societies Of Syro-Mesopotamia*. Digital Data Collection; <https://www.i3-mesop-oil.gwi.uni-muenchen.de>.

- PEDERSÉN, R. K. 2004. "Traditional Arabian Watercraft and the Ark of the Gilgamesh Epos. Interpretations and Realizations". *Proceedings of the Seminar for Arabian Studies* 34, 231-238.
- POTTS, D. 1997. *Mesopotamian Civilization. The Material Foundation*. London.
- POWELL, M. 1987-1990. "Masse und Gewichte". *Reallexikon der Assyriologie und Vorderasiatischen Archäologie* 7, 457-517.
- OUYANG, X. 2013. *Monetary Role of Silver and its Administration in Mesopotamia during the Ur III Period (c. 2112-2004 BCE): A Case Study of the Umma Province*. *Biblioteca del Próximo Oriente Antiguo* 11. Madrid.
- SALLABERGER, W. 1999. "Ur III-Zeit". In P. Attinger, M. Wäfler (eds) *Mesopotamien. Akkade Zeit und Ur III Zeit. Orbis Biblicus et Orientalis* 160/1, 121-390. Freiburg/Göttingen.
- SELZ, G. 1993. *Altsumerische Wirtschaftsurkunden aus amerikanische Sammlungen*. *Freiburger Altorientalische Studien* 15/2 2. Stuttgart.
- 1995. *Untersuchungen zur Götterwelt des altsumerischen Stadtstaates von Lagaš*. *Occasional Publications of the Samuel Noah Kramer Fund* 13. Philadelphia.
- 2011. "Zur Holzwirtschaft im altsumerischen Lagaš". In L. Vacin (ed.) *U₄ du₁₁-ga-ni sa₂ mu-ni-ib₂-du₁₁: Ancient Near Eastern Studies in Memory of Blahoslav Hruška*, 213-246 Dresden.
- SIGRIST, M. 2006. "Droit de pêche. Tablette St. Etienne 26". In A.K. Guinan et al (eds.) *If a Man Builds a Joyful House. Assyriological Studies in Honor of Erle Verdun Leitchy*. *Cuneiform Monograph* 31, 391-399. Leiden/Boston.
- STEINKELLER, P. 1981. "Studies in Third Millennium Paleography: Signs TIL and BAD". *Zeitschrift für Assyriologie* 71, 19-28.
- VELDHUIS, N. 2014. *History of the Cuneiform Lexical Tradition. Guides to the Mesopotamian Textual Records* 6. Münster.
- VOSMER, T. 2003. "The Magan Boat Project: a Process of Discovery, a Discovery of a Process". *Proceedings of the Seminar for Arabian Studies* 33, 49-58.
- 2011. "The Jewel of Muscat Project: Reconstructing an Early Ninth-Century CE Shipwreck". *Proceedings of the Seminar for Arabian Studies* 41, 411-424.
- WAGENSONNER, K. 2020. "Food: Its Gathering, Storage, and Consumption According to the Early Textual Record". In N. Borrelli, G. Scazzosi (eds) *After the Harvest. Storage Practices and Food Processing in Bronze Age Mesopotamia*, 7-28. Turnhout.
- WESTENHOLZ, A. 1999. "The Old Akkadian Period: History and Culture". In P. Attinger, M. Wäfler (eds) *Mesopotamien. Akkade Zeit und Ur III Zeit. Orbis Biblicus et Orientalis* 160/1, 17-120. Freiburg/Göttingen.
- WIDELL, M. 2008. "The Ur III Metal Loans from Ur". In S.J. Garfinkle, J.C. Johnson (eds) *The Growth of an Early State in Mesopotamia. Studies in Ur III Administration: Proceedings of the First and Second Ur III Workshops at the 49th and the 51st Rencontre Assyriologique Internationale, London July 10, 2003 and Chicago July 19, 2005*, 207-233, Madrid.
- 2009. "Schiff und Boot. A. In sumerischen Quellen". *Reallexikon der Assyriologie und Vorderasiatischen Archäologie* 12, 158-160.
- WIDELL, M. et al. 2013. "Staple Production, Cultivation and Sedentary Life". In T.J. Wilkinson et al. (eds) *Models of Mesopotamian Landscapes: How Small-Scale Processes Contributed to the Growth of Early Civilizations*, 811-101. Oxford.