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ORIGINAL RESEARCH ARTICLE

Record-Keeping in Small-scale Aquaculture: Perceptions and Challenges

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ABSTRACT

Record-keeping is a critical management tool in aquaculture, but such record-keeping practices among fish farmers in Ghana remain inconsistent. The study aimed to examine the status, perceptions, and challenges of record-keeping. Structured questionnaires were administered to 120 fish farmers in the northern and southern parts of the Bono region, Ghana. The data obtained were analyzed to determine the importance and challenges of record keeping using the SPSS statistical tool. Results showed that, though fish farmers in both southern (Sr) and northern (Nr) sampling locations had high perception (Mean score > 4.13) about record keeping for profitability, decision-making, and access to financial support, only a few (Nr = 31 %; Sr = 47 %) regularly kept records. Paper notebooks were the dominant format for record keeping among the respondents (Nr = 100 %; Sr = 73 %), while digital methods such as spreadsheets were rarely adopted. Illiteracy (Nr = 50 %; Sr = 60 %) and the time factor (Nr = 30 %; Sr = 30 %) were the key challenges confronting record keeping among fish farmers. Training on record keeping, age, and years of experience were key factors that positively influenced record-keeping behavior among fish farmers in Ghana. Based on the findings, continuous training by extension officers, awareness and user-friendly digital tools are recommended to strengthen record-keeping practices and promote sustainable aquaculture growth in Ghana.

Keywords: *Small-scale fish farming, Ghana, record keeping, training, extension services*

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INTRODUCTION

The fisheries sector plays a vital role in Ghana's economy and food security. Fish consumption in Ghana averages 26 kg per capita annually, exceeding both global (20 kg) and African subregional (10 kg) averages (Dandi et al., 2024). Domestic fisheries supply about 60% of total protein intake and account for 80% of local fish production (Asiedu et al., 2017). With national GDP growth at 5%, fisheries contribute 1.01% annually, of which aquaculture provides 0.12% (MOFAD, 2023). Rising demand, driven by population growth (2.13%) and declining marine stocks, has accelerated aquaculture expansion (GSS, 2015; Manga et al., 2023).

Aquaculture production in Ghana increased from 64,004 metric tonnes in 2020 to 116,108 metric tonnes in 2023 (MOFAD, 2024). Aquaculture systems used in Ghana include earthen ponds, cages, and concrete tanks, with floating cages along Lake Volta accounting for 90% of production (Ayivor and Ofori, 2017; Magna et al., 2021). Nile tilapia (Oreochromis niloticus) dominates output, contributing over 80% of the farmed fish harvest (Amenyogbe et al., 2018). In 2018, production reached 76,600 metric tonnes, valued at USD 200 million (Ragasa et al., 2022). Ghana has remained the second largest tilapia producer in sub Saharan Africa since 2018, after Egypt. Growth in aquaculture, averaging 28% annually between 2006 and 2019, was driven by cage aquaculture, improved breeding, and research investments (Tall and Failler, 2012; Ameworwor et al., 2019; Magna et al., 2023). Despite these gains, challenges in aquaculture still persist, including inadequate management, limited funding, poor infrastructure, and weak adoption of digital record keeping (Dandi et al., 2024).

Record keeping is a critical management tool for monitoring the productivity and financial performance of a fish farm business (Asiedu et al., 2017). However, adoption of record-keeping among small-scale fish farmers is low due to limited education and weak extension services (Ashley Dejo et al., 2023). National literacy in Ghana averages 68.5%, with some regions, such as Bono East, recording literacy rates below 60% (GIPC, 2022). Restricted access to extension officers further reduces sensitization on record keeping (Nzaligo et al., 2025). Records typically include stock, production, finances, mortalities, and water quality, all of which are essential for decision making and profitability in the fish farming business (Aladetohun et al., 2024). Furthermore, adoption of record keeping is influenced by socio economic factors such as age, education, and farming experience (Tackie et al., 2022). In addition, many fish

farmers rely on manual, inconsistent record-keeping methods (Basir et al., 2024; Kuteesa and Kyotalimye, 2019), which limits their ability to evaluate efficiency and avert losses in the fish farming business (Joffre et al., 2018; Munthali et al., 2023).

In Sunyani Municipality, 80% of farmers engage in record keeping, largely due to extension support, though most rely on notebooks rather than digital tools (Asiedu et al., 2017). Nonetheless, perceptions of record keeping, its importance, and challenges remain underexplored in many regions of Ghana where aquaculture is prominent. Without evidence based strategies to improve the adoption of record-keeping practices, small scale fish farmers risk marginalization in a modernizing aquaculture sector (Obwanga et al., 2017; Odende et al., 2022). Given that, the objective of this study was to examine record keeping practices among Ghanaian fish farmers. Specifically, the study aimed to: (i) assess perceptions of record keeping; (ii) identify challenges; and (iii) analyze socio economic factors influencing adoption. Findings will inform strategies to strengthen record keeping behaviour among small-scale fish farmers, enhance productivity, and improve food security in Ghana.

MATERIALS AND METHODS

Description of the study area

The study was conducted in four sampling locations in the Bono East region of Ghana. These were Techiman, Nkoranza, Jema and Kintampo located on the coordinates 7°35'15.28"N, 1°55'59.54"W; 7°33'39.84"N, 1°42'22.48"W; 7°54'5.65"N 1°46'8.26"W and 8° 3'35.08"N, 1°43'39.00"W respectively (Figure 1). Nkoranza and Techiman are located in the South of the region, whereas Kintampo and Jema are situated in the North (GSS, 2021). Ponds in the study areas are, on average, small, with an estimated average pond size of 407m2 (Boateng et al., 2022). Most fish farmers in the study area practice semi-intensive pond aquaculture (Wattage, 2009). The majority of the inhabitants are farmers, with a few engaged in fish farming as a source of livelihood.

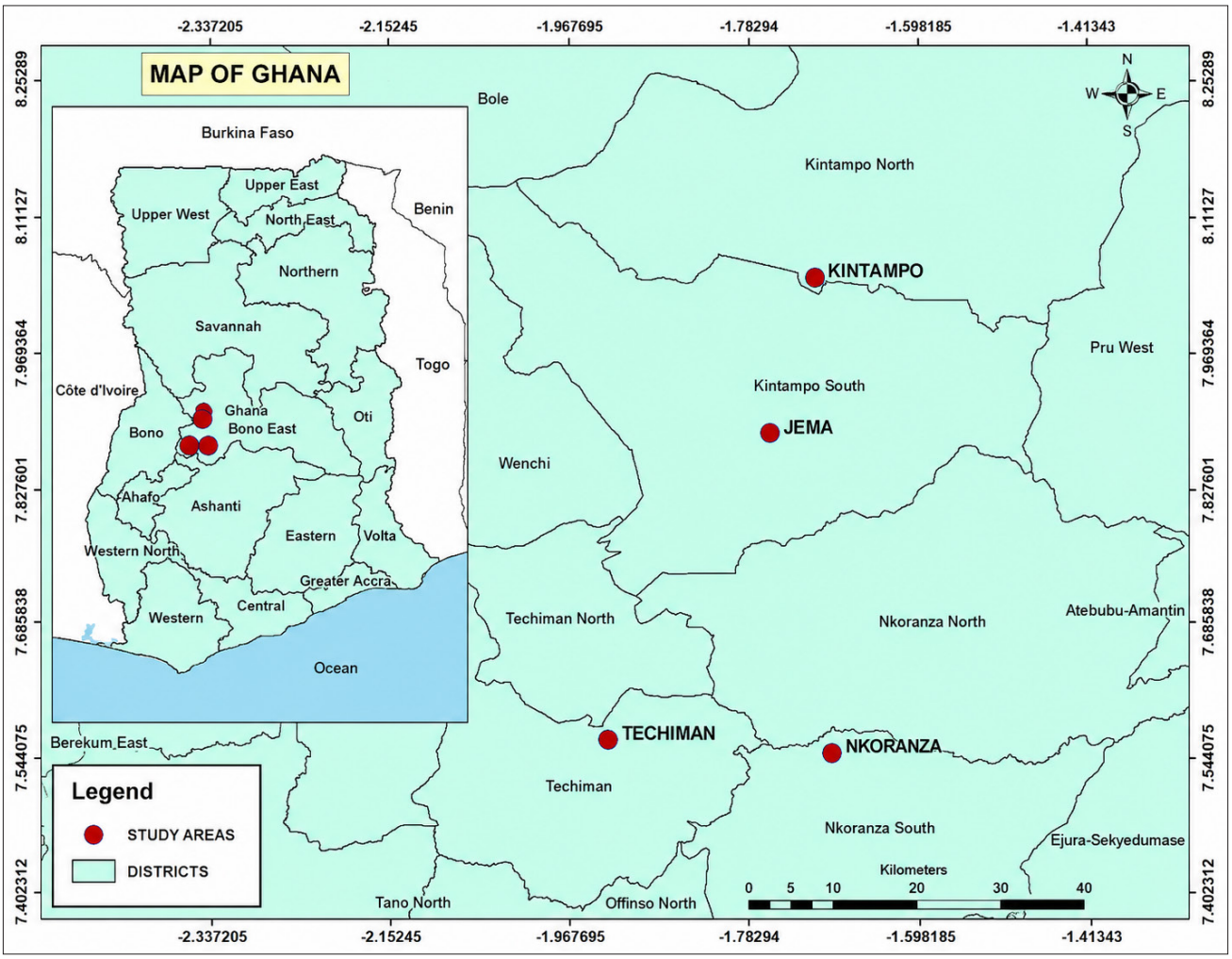

Figure 1. Map showing the study areas.

Data collection

A purposive sampling technique was used to identify the sampling units (i.e., fish farms) and sampling locations for the study (Obilor, 2023). Data for the study were collected from June to July 2025 with the aid of a local facilitator, whose assistance was particularly important during difficult periods of local communication. Selection of respondents for the study was based on the following characteristics: i) should be an active fish farmer; ii) should have at least one year of farming experience; and iii) should be operating in the sampling locations. The sampling instrument for the study, the questionnaire, was used to seek answers to the following questions: i) demographics of respondents; ii) status of record keeping among fish farmers, and iii) challenges in record keeping among fish farmers. The questionnaire for the study was developed based on previous studies and validated through expert review by fisheries extension officers. A pilot

test was conducted with 10 farmers outside the sampling areas to refine wording and ensure clarity. Internal consistency of perception items was assessed using Cronbach's alpha (α = 0.82). Questionnaires were administered face-to-face upon receiving consent from selected respondents. Audio or video recordings were used to capture responses during the study period. Respondents were interviewed using both English and local languages. The sample size (n) of fish farms visited for the study was estimated using the Yamane (1967) formula for a finite population:

$$n = \frac{N}{1 + N(e^2)}$$

Where n = required sample size, N = population size (N = 172 fish farms) and *e* = margin of error (level of precision, expressed as a proportion, e.g., 0.05 for 5%). In all, 120 fish farmers were administered questionnaires in a cross-sectional study.

Data analysis

Qualitative responses from the questionnaire were converted to quantitative data and analyzed using SPSS v26 after data cleaning (Halevi Hochwald et al., 2023). Descriptive and frequency statistics were performed to assess the percentages of responses for each research question (Koh and Owen, 2000). Goodness-of-fit chi-square tests were conducted for demographic variables to determine whether the observed and expected frequencies were equal (Archer and Lemeshow, 2006). A linear regression model was employed to determine the influence of factors on record-keeping among fish farmers (Adewuyi et al., 2010). A chi-square test of independence was conducted between sampling locations and variables such as causes, number of incidences, preventive measures, and effects to identify any significant relationships or associations at a 95% confidence interval and a *p*-value of < 0.05 (Das et al., 2022).

RESULTS

From Table 1, the age distribution of fish farmers showed that in the South, 50% of respondents were aged 51 or older, while in the North, 30% were aged 41 or older. In terms of gender, more than 60% of respondents were male, including 80% in the North and 70% in the South. Educational attainment varied: in the North, half of the respondents (50%) had primary or secondary education, whereas in the South, 30% reported A level, technical vocational, or tertiary education. Work experience was generally low, with more than 60% of respondents in both regions reporting fewer than 10 years of experience in fish farming (70% in the North and 60% in the South). Respondents with 11–20 years of experience accounted for 30% in the North and 20% in the South, while long term experience (21 years and above) was higher in the South (20%). However, these differences were not statistically significant (p = 0.44). The type of fish farmed was similar across regions, with 40% of respondents in both the North and South raising catfish and 40% raising tilapia. In contrast, feed type showed a significant difference (p = 0.02), with 70% of respondents in the North and 50% in the South relying on commercial feed. A chi square Goodness-of-fit test revealed significant deviation from a 1:1 ratio of proportions for responses on education level and type of feed used (p < 0.05).

Table 1. Demographic information of fish farmers in the north and southern sampling locations (Significant value are in bold).

Variables	North	South	Chi-square value	df	*p*-value
Age					
Below 30	4.0 (10%)	12.0 (16%)	5.49	3.00	0.14
31-40	10.0 (20%)	16.0 (20%)			
41-50	14.0 (30%)	13.0 (20%)			
Above 51	14.0 (30%)	37.0 (50%)			
Gender					
Male	32.0 (80%)	56.0 (70%)	0.27	1.00	0.60
Female	10.0 (20%)	22.0 (30%)			
Educational level of respondent					
None	4.0 (10%)	19.0 (20%)	17.17	3.00	**0.00**
Primary/JHS	20.0 (50%)	11.0 (10%)			
A level/Secondary/SHS/Vocational	10.0 (20%)	22.0 (30%)			
Tertiary	8.0 (20%)	26.0 (30%)			
Years of experience					
Below 10	28.0 (70%)	46.0 (60%)	3.73	4.00	0.44
11-20 years	12.0 (30%)	19.0 (20%)			
21-30 years	1.0 (0%)	6.0 (10%)			
Above 31	1.0 (0%)	7.0 (10%)			
Type of fish farmed					
Catfish	15.0 (40%)	31.0 (40%)	2.39	2.00	0.30
Tilapia	15.0 (40%)	34.0 (40%)			
Tilapia / Catfish	12.0 (20%)	13.0 (20%)			
Type of feed used					
On farm made feed	11.0 (30%)	38.0 (50%)	5.74	1.00	**0.02**
Commercial feed	31.0 (70%)	40.0 (50%)			

From Figure 2, respondents in the South reported higher perception (>4.13) of record-keeping across several dimensions. Mean scores (Ms) included tracking fish growth (4.28), identifying problems (4.15), access to financial support (4.46), enhancing profits (4.64), improved decision-making (4.67), and overall importance (4.78). Respondents in the North recorded lower mean scores for the same perceptions: record-keeping as important (4.02), improving decision-making (3.90), enhancing profits (3.98), access to financial support (3.81), aiding in problem identification (3.88), and tracking fish growth (3.64).

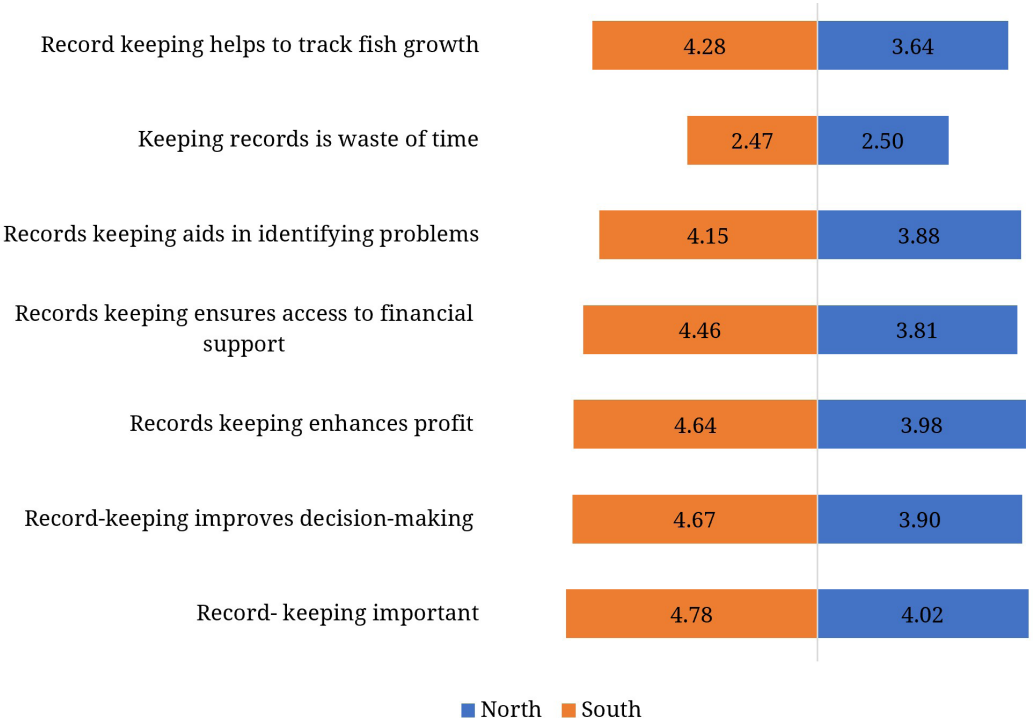

Figure 2. Perceptions about record keeping among fish farmers in the South and North of the study locations.

From Table 2, fewer than half of the respondents reported keeping records regularly, including 31% in the North and 37% in the South. In terms of record-keeping formats, paper notebooks were the most common, used by all respondents in the North (100%) and 73% in the South. More than half of the respondents indicated that they had never changed their record-keeping format, with 85% in the North and 76% in the South reporting consistency. Regarding ease of use, 25% of respondents in the North and 75% in the South stated that their current format was easy to read and understand. Regarding record update frequency, 46% of respondents in the North and 29% in the South reported updating records daily. A chi-square test of independence revealed no significant relationship between location (North and South) and the variables associated with record-keeping status among small-scale fish farmers during the study period (p > 0.05).

Table 2. Status of record keeping among fish farmers in Northern and Southern sampling locations of the study (Significant value are in bold).

Variables		North	South	Chi-square value	df	*p*-value
Do you regularly keep records of your farming activities	Yes	13.00 (31%)	37.00 (47%)	3.05	1.00	0.08
	No	29.00 (69%)	41.00 (53%)			
What format do you use for keeping records	Paper notebook	12.00 (100%)	27.00 (73%)	4.08	2.00	0.13
	Spreadsheet/excel	0.00 (0%)	1.00 (3%)			
Have you ever changed this type of record keeping	Yes	2.00 (15%)	9.00 (24%)	0.45	1.00	0.50
	No	11.00 (85%)	28.00 (76%)			
Why do you use this type of record keeping	Easy to read and understand	10.00 (25%)	30.00 (75%)	2.91	2.00	0.23
	Easy to update	4.00 (10%)	8.00 (10%)			
	No idea	28.00 (67%)	40.00 (51%)			
How often do you update your records	Daily	6.00 (46%)	11.00 (29%)	2.11	4.00	0.72
	Weekly	2.00 (15%)	6.00 (16%)			
	Monthly	3.00 (23%)	8.00 (21%)			
	Occasionally	1.00 (8%)	5.00 (13%)			
	Never	1.00 (8%)	8.00 (21%)			

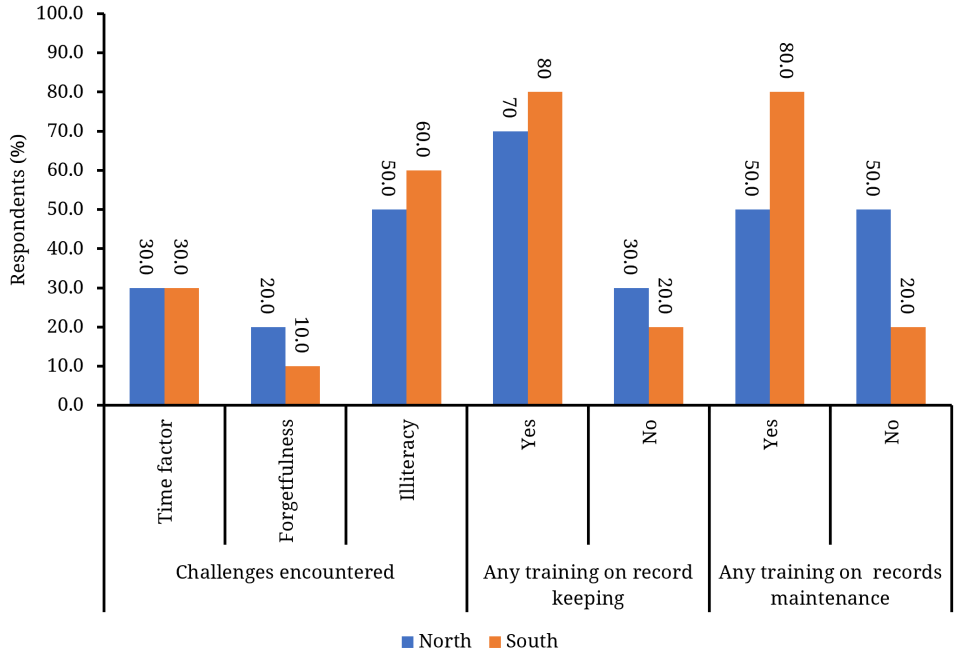

Figure 3. Respondents' opinion on challenges, government support and training on record keeping.

From Table 3, the linear regression analysis examined the relationship between regular record-keeping (dependent variable) and some selected socio-demographic factors (independent variables: age, gender, education, and years of experience). Age (B = 0.13), years of experience (B = 0.13), receipt of training on record-keeping (B = 0.19), and gender (B = 0.03) all showed positive associations with regular record-keeping. In contrast, education exhibited a marginally significant negative relationship with record-keeping behavior (B = –0.18, $p = 0.05$).

Table 3. Linear regression model of dependent variable (do you keep record regularly) and independent variables (age, gender, education and years of experience of respondents) (Significant value are in bold).

Model	Standardized coefficients	Std. Error	*p*-value
(Constant)	0.94	0.29	**0.00**
Age	0.13	0.04	0.14
Gender	0.03	0.10	0.74
Educational level	-0.18	0.04	**0.05**
Years of experience	0.13	0.05	0.16
Training on record keeping	0.19	0.13	0.12

DISCUSSION

Perceptions of record keeping among fish farmers

Fish farmers from the current study perceived record keeping as essential for identifying problems, accessing financial support, enhancing profitability, and improving decision making. Record keeping enables fish farmers to identify strengths and weaknesses in their operations, which serve as indicators of potential challenges (Atah, 2018). Rutto et al. (2016) noted that keeping farm records signals business performance and facilitates access to financial institutions. Similarly, Onoja et al. (2025) from Nigeria reported that farmers who maintained records achieved higher incomes and improved profitability. Ashley Dejo et al. (2023) emphasized that effective record keeping practices provide data that are critical for decision making in fish farm businesses. In this study, farmers in both the northern and southern locations strongly perceived record keeping as vital for decision making and profitability. This high perception may be attributed to relatively higher literacy levels among respondents, which enhance awareness of record keeping benefits (Basir et al., 2024).

Status of record keeping among fish farmers

Despite recognizing its importance, many respondents reported not keeping records regularly. Yadeta et al. (2020) identified illiteracy, time constraints, and lack of awareness as major reasons for irregular record keeping behaviour among small-scale fish farmers. Respondents who maintained records consistently could be those either managing larger fish farms or operating full time businesses, where record keeping is essential for sustainability (Bolaji, 2023). The lack of consistent record keeping among fish farmers could contribute to insufficient data on small scale aquaculture in Ghana, hindering effective management (Agbebi, 2012). Most respondents relied on paper notebooks, a practice also reported among small scale fish farmers in Nigeria, where handwritten ledgers and notebooks remain common (Aladetohun et al., 2024; Maddali et al., 2018). Although paper records are easy to use, they are prone to errors, misplacement, and inefficiency (Kuteesa and Kyotalimye, 2019). These limitations, however, are offset by their simplicity, which may explain why fish farmers are reluctant to adopt alternative formats. Spreadsheet based record keeping was rarely used, likely due to limited access to

technology and training (Rotz et al., 2019), despite advantages such as automated calculations and easy data retrieval (Cui and Wang, 2023). The transition from manual to digital record keeping has significant implications for aquaculture management in Ghana. Digital tools, including mobile applications, SMS based reporting systems, and spreadsheet platforms, offer automated calculations, secure storage, and real time tracking of farm data (Basir et al., 2024). Adoption of these technologies could reduce errors associated with paper notebooks, improve efficiency, and enable farmers to monitor productivity more effectively (Cui & Wang, 2023). Beyond farm level benefits, digital records would facilitate data aggregation for national planning, enhance transparency for financial institutions, and strengthen evidence based policymaking in the aquaculture sector.

Factors influencing record keeping among fish farmers

Respondents identified time constraints, forgetfulness and illiteracy as key challenges. Ashley Dejo et al. (2023) similarly reported that time limitations and procrastination hinder record keeping. Some fish farmers often handle multiple farm- and non farm activities (Aladetohun et al., 2024; Johl et al., 2001), leaving little time for detailed records. This either makes it difficult for them to prioritize record-keeping or causes them to forget to record farm activities (Amos and Bolorunduro, 2000). Illiteracy further constrains adoption, as low numeracy levels in resource poor communities limit fish farmers' ability to maintain records (Minae et al., 2008; Ballah and Azibo, 2023). Some fish farmers also viewed record keeping as unnecessary, reflecting a perception that aquaculture is not a business venture (Omotesho et al., 2022). Demographic factors such as age, gender, years of experience, and training positively influenced record keeping. Similar findings have been reported elsewhere, where literacy and training improved record keeping behavior among fish farmers (Omotesho et al., 2022; Adedapo and Adekunmi, 2019; Ibrahim et al., 2018; Rauniyar, 1998; Dudafa, 2013; Yadeta et al., 2020). Nonetheless, education level in this study showed a negative relationship with record keeping, contrasting with Yadeta et al. (2020). This may be because higher education provides alternative livelihood opportunities, reducing the time and priority given to aquaculture record keeping practices.

Policy implications

In Ghana, strengthening extension services by technical officers at the district level is critical, with training delivered in local languages and simplified formats to overcome literacy and time barriers. Fisheries extension services should also be enhanced to provide hands-on training and technical support, bridging the gap between fish farmers and technology providers. Government and private sector partnerships should incentivise digital record keeping by subsidizing mobile applications or SMS based systems. Linking record keeping compliance to access to microcredit, loans, or national awards could further encourage adoption among small-scale fish farmers. Peer learning groups and mentorship programs would enable experienced fish farmers to support others, while youth oriented digital literacy campaigns would ensure the sustainability of record keeping practices. Globally, standardized record keeping frameworks developed by FAO and regional fisheries bodies could provide adaptable templates. Open source, multilingual digital tools with offline functionality would benefit resource poor communities. South South cooperation, particularly between Egypt and Ghana, could strengthen knowledge exchange on record keeping innovations. Furthermore, integrating record keeping into sustainability certifications and international databases would enhance monitoring, research, and food security planning.

CONCLUSION

This study examined the perceptions, practices, and challenges of record keeping among fish farmers in Ghana. Most respondents recognized record keeping as important for profitability, decision making, and access to financial support; however, fewer than half maintained records regularly. Paper notebooks were the predominant format for record-keeping among respondents, despite their limitations. Demographic factors such as age, gender, training, and farming experience positively influenced record keeping behavior, while education showed a negative association. To improve adoption, extension services should intensify training on record keeping, delivered in accessible formats. Government and private sector initiatives should provide financial incentives and promote the use of digital tools, with subsidies to support uptake among small scale farmers. Strengthening awareness and training will enhance record keeping practices, improve farm management, and contribute to sustainable aquaculture and food security in Ghana.

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None

AUTHOR CONTRIBUTIONS

S. K. K. A: Conceptualization, methodology, validation, formal analysis, writing - review and editing and supervision. P. A.: Investigation, writing – original draft.

DECLARATIONS

Informed consent statement

This study does not involve ethical clearance. However, the researchers explained the study's objectives to respondents to obtain their informed consent. This ensured that participation was voluntary, with respondents fully aware that their information would be kept confidential and used only for the study.

Conflict of interest

The authors declare no conflict of interest.

AI Desclosure

The authors declare that no Artificial Intelligence (AI) or AI-assisted technologies were used in the preparation of this manuscript.

REFERENCES

Adedapo, A. O., and Adekunmi, A. O. (2019). Factors influencing the choice of record keeping among poultry farmers in Ekiti state, Nigeria. *Ife Journal of Agriculture,* 31(1), 1-15 pp.

Adewuyi, S. A., Phillip, B. B., Ayinde, I. A., and Akerele, D. (2010). Analysis of profitability of fish farming in Ogun State, Nigeria. *Journal of Human Ecology*, 31(3), 179-184 pp.

Agbebi, F. O. (2012): Assessment of the Impact of Extension Services on Fish Farming in Ekiti State, Nigeria. *Asian Journal of Agriculture and Rural Development*, Vol. 2, No.1, 62-68 pp. https://doi.org/10.22004/ag.econ.197942

Aladetohun, N.F., Eyo, V.O., and Eriegha, O.J. (2024). A Review of Farm Record-Keeping Practices Among Fish Farmers in Nigeria. *International Journal of Maritime and Interdisciplinary Research*, 6(2), 32-49 pp.

Amenyogbe E., Chen G., Wang Z., Lin M., Lu X., Atujona D., and D Abarike E. (2018). A review of Ghana's aquaculture industry. Journal of Aquaculture and Research Development. 09 (8). https://doi.org/10.4172/21559546.1000545.

Ameworwor, M.Y., Asmah, R., Ofori-Danson, P.K., and Clottey, M.N.K. (2019). Enhancing local fish production through cage aquaculture on the Volta Lake: impacts on capture fisheries. *Journal of Fisheries and Coastal Management*, Vol (1), 1 -7 pp. DOI: 10.5455/jfcom.20190313031430.

Amos, T. T. and Bolorunduro, P. I. (2000). *Economics of aquaculture production.* Extension Bulletin No 107, Fisheries Series No. 5, National Agricultural Extension and Research Liaison Services, Ahmadu Bello University, Zaria, 1 –30 pp.

Archer, K. J., and Lemeshow, S. (2006). Goodness-of-fit test for a logistic regression model fitted using survey sample data. *The Stata Journal*, 6(1), 97-105 pp. https://doi.org/10.1177/1536867X0600600106

Ashley-Dejo, S. S., Oyetunji, O. T., Sule, S.O., and Fabiyi, O. O. (2023). Factors Influencing choice of record keeping among small-scale fish farmers in Osun State Nigeria. *Nigerian Journal of Animal Science*. 25(3), 47-56 pp.

Asiedu, B., Adetola, J.O., and Odame Kissi, I. (2017). Aquaculture in troubled climate: Farmers' perception of climate change and their adaptation. *Cogent Food and Agriculture*, 3(1), 1 16 pp. https://doi.org/10.1080/23311932.2017.1296400

Asiedu, B., Nunoo, F. K. E., and Iddrisu, S. (2017). Prospects and sustainability of aquaculture development in Ghana, West Africa. Cogent Food and Agriculture. 3, (1), 1 – 13 pp. https://doi.org/10.1080/23311932.2017.1349531.

Atah, C. A., and Bessong, E. B. (2018). Impact of Record Keeping for Sustainability of small-Scale Business Operators for National Economy Development in Nigeria. *Nigerian Journal of Business Education-Volume*, 5(1), 1- 13 pp.

Ayivor, J. S., and Ofori, B. D. (2017). Impacts of hydrological changes of the Volta River on local livelihoods: lessons for re-operation and re-optimisation of the Akosombo and Kpong Dams. *Dams, development and downstream communities: implications for re-optimising the operations of the Akosombo and Kpong Dams in Ghana, edited by: Ntiamoa-Baidu, Y., Ampomah, B.Y, and Ofosu, E.A, Digibooks Ghana Ltd, Tema, Ghana*, 63-93 pp.

Ballah, J. T., and Azibo, B. R. (2023). Determinants for record keeping among farmers in Tubah Subdivision, Northwest region of Cameroon. *American Journal of Humanities and Social Sciences Research*, Vol 7 (2). 98-104 pp.

Basir, M. S., Buckmaster, D., Raturi, A., and Zhang, Y. (2024). From pen and paper to digital precision: a comprehensive review of on-farm record keeping. *Precision Agriculture*, 25(5), 2643-2682 pp. https://doi.org/10.1007/s11119-024-10172-7

Boateng, C. N., Mtethiwa, A., and Agyakwah, S. K. (2022). Drivers of adoption intensity of pond aquaculture: the case of Ghana. *Aquaculture*, 560 (15). https://doi.org/10.1016/j.aquaculture.2022.738597

Bolaji, S.A. (2023). Farm accounting record keeping and its impact on the profitability of farm business. *International Journal of Social Sciences and Management Review*, 6(3), 272-298 pp. https://doi.org/10.37602/IJSSMR.2023.6319

Cui, L., and Wang, W. (2023). Factors affecting the adoption of digital technology by farmers in China: A systematic literature review. *Sustainability*, 15(20), 1 – 14 pp. https://doi.org/10.3390/su152014824

Dandi, S. O., Abarike, E. D., Abobi, S. M., Doke, D. A., Lyche, J. L., Addo, S., and Cudjoe, K. S. (2024). Knowledge, attitudes, and practices of antibiotic use among small-, medium-, and large-scale fish farmers of the Stratum II of the Volta Lake of Ghana. *Antibiotics*, 13(7), 1 -20 pp. https://doi.org/10.3390/antibiotics13070582

Das, B. K., Jha, D. N., Sahu, S. K., Yadav, A. K., Raman, R. K., and Kartikeyan, M. (2022). Chi square test of significance. *In Concept building in fisheries data analysis* (pp. 81-94). Singapore: Springer Nature Singapore.

Dudafa, U. J. (2013). Record keeping among small farmers in Nigeria: Problems and prospects. *International Journal of Scientific Research in Education*, 6(2), 214-220 pp.

Ghana Statistical Service [GSS] (2015). Revised 2015 annual gross domestic product" Accra, 2015, https://www.scirp.org/(S(czeh2tfqw2orz553k1w0r45))/reference/referencepapers.aspx?referenceid=2490112.

Ghana Statistical Service [GSS] (2021). Ghana 2021 population and housing census, general report (volume 3A): population of regions and districts.

Ghana Investment Promotion Centre [GIPC] (2022). Ghana's Education Sector Report. Ghana. 100 pp.

Halevi Hochwald, I., Green, G., Sela, Y., Radomyslsky, Z., Nissanholtz-Gannot, R., and Hochwald, O. (2023). Converting qualitative data into quantitative values using a matched mixed-methods design: A new methodological approach. *Journal of Advanced Nursing*, 79(11), 4398-4410 pp. https://doi.org/10.1155/2021/2273327.

Ibrahim, M. K., Adisa, R. S., Ahmed, T. A., and Ebenehi, O. (2018). Determinants of farm record keeping among small scale poultry farmers in Kogi state, Nigeria. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems*, 8, 185 – 189 pp.

Joffre, O. M., Klerkx, L., and Khoa, T. N. (2018). Aquaculture innovation system analysis of transition to sustainable intensification in shrimp farming. *Agronomy for Sustainable Development*, 38(3), 1 – 11 pp . https://doi.org/10.1007/s13593-018-0511-9

Johl, S. S., and Kapur, T. R. (2001). Fundamentals of Farm Business Management. Kalyani Publishers, 253-259 pp.

Koh, E. T., and Owen, W. L. (2000). Descriptive research and qualitative research. In Introduction to Nutrition and Health research. Boston, MA: Springer US. 219-248 pp.

Kuteesa, A., and Kyotalimye, M. (2019). Documentation and data handling: how can Africa promote record keeping and investment in data management? *African Journal of Food, Agriculture, Nutrition & Development*, 19(1), 14171-14189 pp. https://doi.org/10.18697/ajfand.84.BLFB1014

Magna E. K., Koranteng S. S., Donkor A., and Gordon C. (2021). Health risk assessment and levels of heavy metals in farmed Nile Tilapia (Oreochromis niloticus) from the Volta Basin of Ghana. *Journal of Chemistry*, 2021 (1), 1 – 10 pp. , https://doi.org/10.1155/2021/2273327

Magna, E. K., Mensah, E. T. D., Mabe, F. N., Johnson-Ashun, M., Konadu, L. O., and Appiah, E. K. (2023). Profitability analysis of small-scale cage aquaculture farms in the Volta Lake of Ghana. *Aquaculture Research*, 2023(1), 1 -10 pp. https://doi.org/10.1155/2023/1314660

Minae, S., Baker, D., and Dixon, J. (2008). Status of farm data systems and farmer decision support in Sub-Saharan Africa. FAO Rome.

Ministry of Fisheries and Aquaculture Development [MOFAD] (2024). 2023 Annual Performance Report. Fisheries Commission, Ghana. 154 pp.

Nzaligo, U. C., Tarimo, R. B., and Mtega, W. P. (2025). Aquaculture knowledge needs and accessibility among cage fish farmers in Mwanza, Tanzania. *African Quarterly Social Science Review*, 2(3), 375-386 pp. DOI: https://doi.org/10.51867/AQSSR.2.3.32

Obilor, E. I. (2023). Convenience and purposive sampling techniques: Are they the same. *International Journal of Innovative Social and Science Education Research*, 11(1), 1-7 pp.

Odende, T., Ogello, E. O., Iteba, J. O., Owori, H., Outa, N., Obiero, K. O., and Osia, M. M. (2022). Promoting sustainable smallholder aquaculture productivity through landscape and seascape aquapark models: a case study of Busia County, Kenya. *Frontiers in Sustainable Food Systems*, 6, 1 -16 pp. https://doi.org/10.3389/fsufs.2022.898044

Onoja, S. A., Ojone, A. S., Michael, O. A., and Tayo, A. (20250. Effect of Financial Records Keeping on the Income of Small-Scale Agribusiness Enterprises in Nasarawa State, Nigeria. *International Journal of Research Publication and Reviews*, 6 (11). 8279-8286 pp.

Omotesho, K. F., Fatodu, P. A., and Ajibade, T. B. (2022). Farm Record Keeping Behaviour of Rural Farming Youths in Ekiti State, Nigeria. *Sarhad Journal of Agriculture*, 38(1). 92 102 pp. https://dx.doi.org/10.17582/journal.sja/2022/38.1.92.102

Ragasa C., Agyakwah S. K., Asmah R., Mensah E. T. D., Amewu S., and Oyih M. (2022). Accelerating pond aquaculture development and resilience beyond COVID: ensuring food and jobs in Ghana. *Aquaculture*, 547. 1 -14 pp. https://doi.org/10.1016/j.aquaculture.2021.737476

Rauniyar, G. P. (1998). Adoption of management and technological practices by fishpond operators in Nepal. *Aquaculture Economics and Management*, 2(3), 89-99. https://doi.org/10.1080/13657309809380221

Rotz, S., Duncan, E., Small, M., Botschner, J., Dara, R., Mosby, I. and Fraser, E. D. (2019). The politics of digital agricultural technologies: a preliminary review. *Sociologia ruralis*, 59(2), 203-229 pp. https://doi.org/10.1111/soru.12233

Rutto, D. K. L., Koome, M., and Kibusi, L. F. (2016). Assessment of the efficiency of farm record keeping in Kenya: A case study of farmers in Cherangani Division Trans-Nzoia EastDistrict, Kenya. *International Journal of Scientific Research in Science andTechnology*, 2(6), 101-105 pp.

Tackie, D. N. O., Jones, K. N., Quarcoo, F. A., Johnson, G. J., Moore, J., and Elliott, A. (2022). Effects of selected characteristics on general and financial record keeping practices of small producers in South Central Alabama. *Journal of Agricultural Science*, 14(7), 15 – 35 pp. https://doi.org/10.5539/jas.v14n7p15.

Tall A. and Failler P. (2012). Fishery and aquaculture industry in Ghana, Report number: Series Report n°1 of the Review of the fishery and aquaculture industry in the 22 ATLAFCO Member States Affiliation: ATFALCO- COMHAFAT. 1 – 51 pp.

Wattage, P. (2009). Millennium Development Goals and aquaculture: indicators to evaluate conservation of the resource base for poverty reduction. In Measuring the contribution of small-scale aquaculture: an assessment (pp. 57-70). Food and Agriculture Organization of the United Nations.

Yadeta, W, Habte, D, Kassa, N, befekadu, B, and Fetene, E. (2020). Dairy farm record keeping with emphasis on its importance, methods, types, and status in some countries. *International Journal of Research*, 8(4), 16-25 pp. https://doi.org/10.20431/2349-0365.0804003.

Yamane, T. (1967). Statistics: An introductory analysis (2nd ed.). New York: Harper & Row.

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