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# Exploring the potential and constraints of smallholder aquaculture in marginalized saline areas in Pakistan

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# Introduction and background

- Pakistan is the sixth-most populous country in the world, with a population of approximately 225 million. More than 20% of the population lives below the national poverty level (World Bank, 2021).
- Fishery and aquaculture have the potential to significantly reduce poverty and food insecurity in Pakistan (Rehman et al., 2019).
- Pakistan ranks low in global aquaculture production (FAO, 2022) - aquaculture produced 162,462 tons of fish in 2020. Over the past five years, the aquaculture sector has grown at a rate of approximately 1.5%.
- Because of the arid and semi-arid climate, rainfall is scarce and irregular in most of the areas and contributes to salinity and waterlogging - salinity in the soil makes land unsuitable for growing crops: **an opportunity for practicing “inland saline aquaculture”** on lands not suitable for crop cultivation - **11.1 million acres (4,49 million ha)**.
- Despite the huge potential of saline aquaculture, the **characteristics of the production systems in Pakistan are still unknown due to data deficiency, making it difficult to understand investment needs that will help in the sector's development.**



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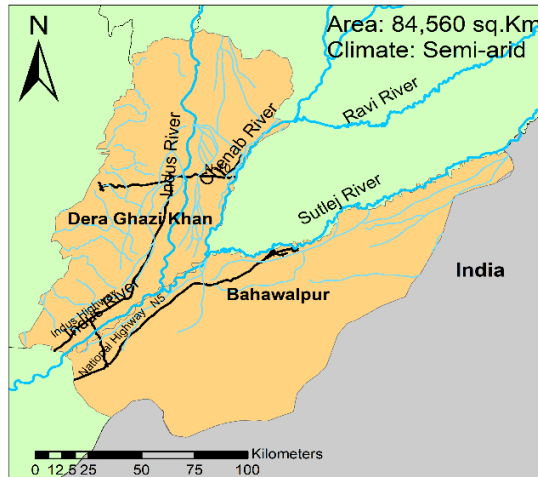
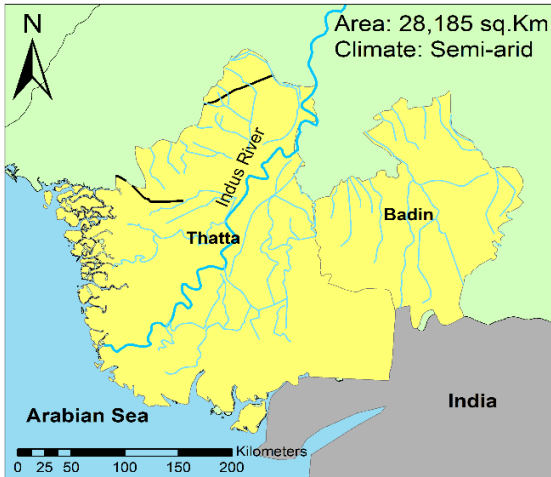
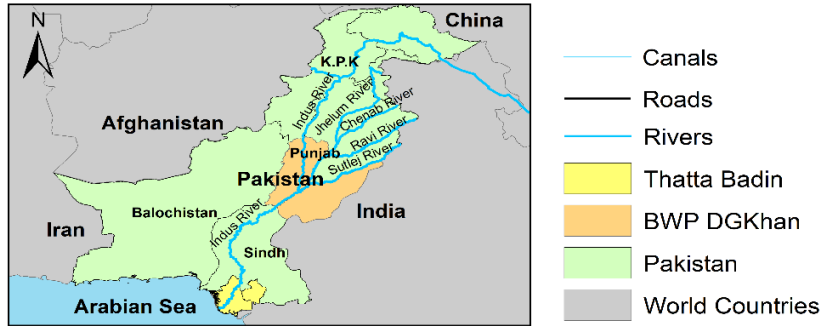
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# Study area - Southern Punjab and Sindh Provinces



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## Key elements

**Soil salinity is a problem** - Punjab, 23% of the area has poor groundwater quality, while in Sindh, 78% of the groundwater is saline. About 40,000 hectares are abandoned within the Indus Basin annually because of salinization.

**Potential for aquaculture** - Since the 1960s, the provincial fisheries departments introduced fish farming techniques in earthen ponds and community reservoirs. Since the 1980s both Indian carp and Chinese carp are farmed in polyculture with other species in the two provinces.

# Methodology

The saline aquaculture farmer survey followed a **purposive sampling methodology**.

A total of 121 farmers were surveyed across five districts from Sindh and Punjab.

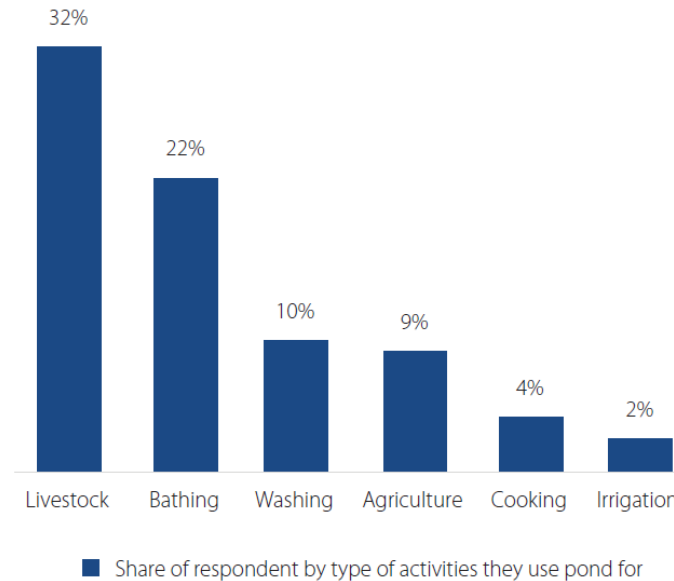
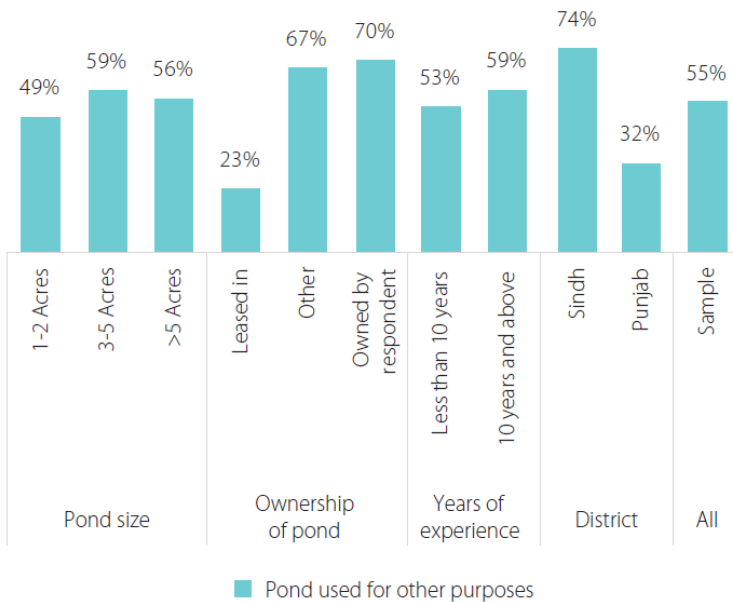
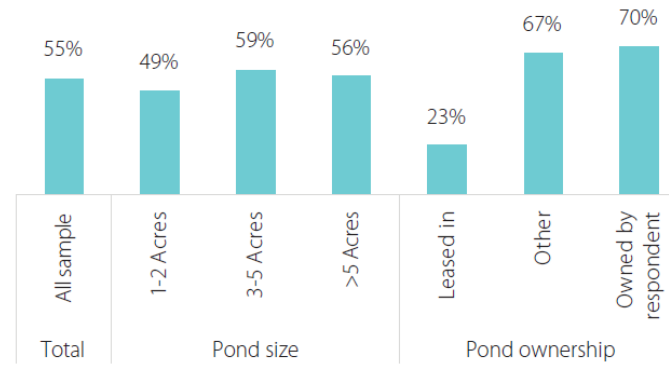
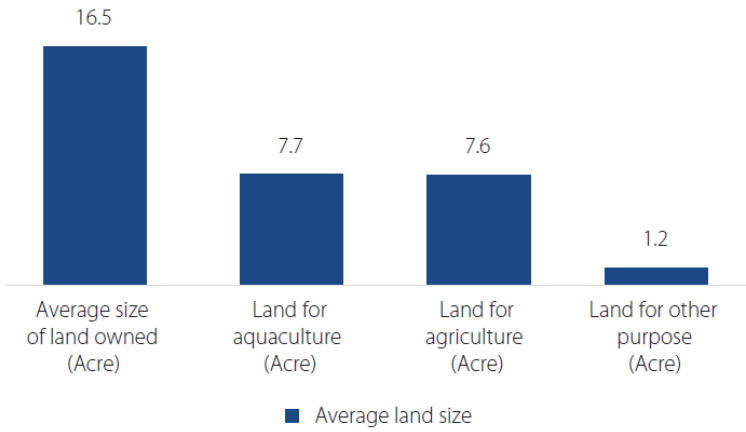
The target population was low-income farmers with pond size used as a proxy to identify this group.

The selection criteria: a) pond salinity must be greater than 2 milliSiemens per centimeter (mS/cm) and b) pond size ranging from one to five acres.

The selected districts shortlisted were in South Punjab (Bahawalpur, Dera Ghazi Khan, and Rahim Yar Khan) and in Sindh (Thatta and Badin).

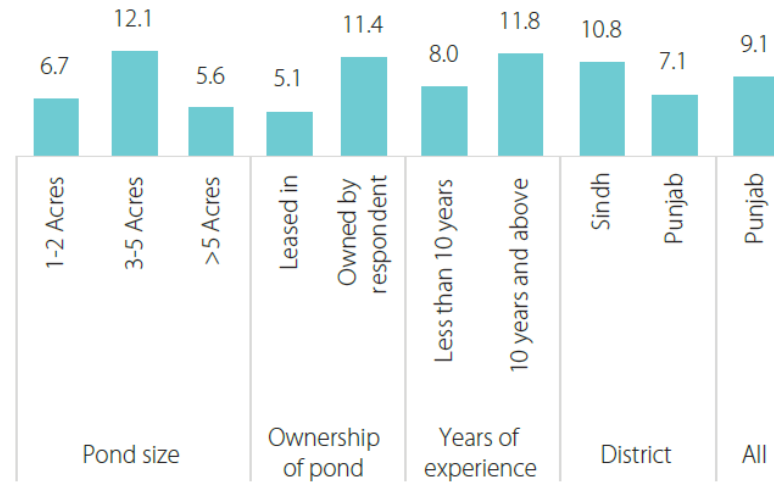
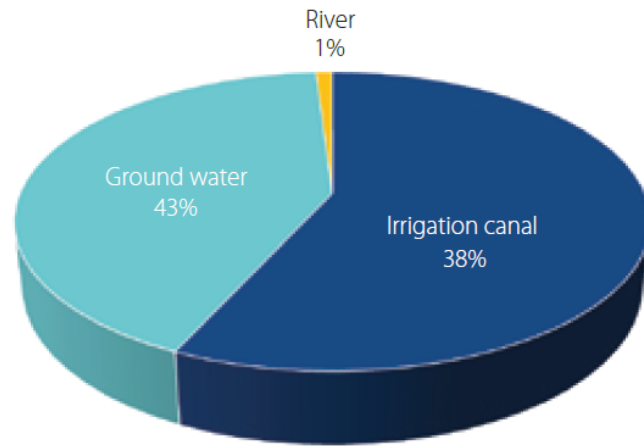
Salinity maps were created for the selected areas. GIS and remote sensing were used to identify villages in collaboration with the Pakistan Council of Research on Water Resources (PCRWR). Local partners and universities were consulted to identify farmers available for interviews.

# Results – land and aquaculture activities



# Water source and water quality monitoring

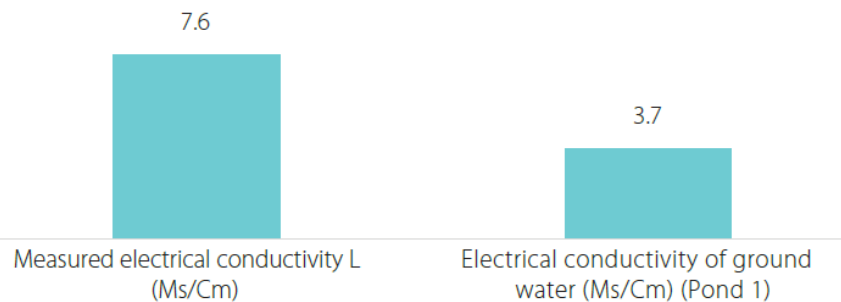
Source of water



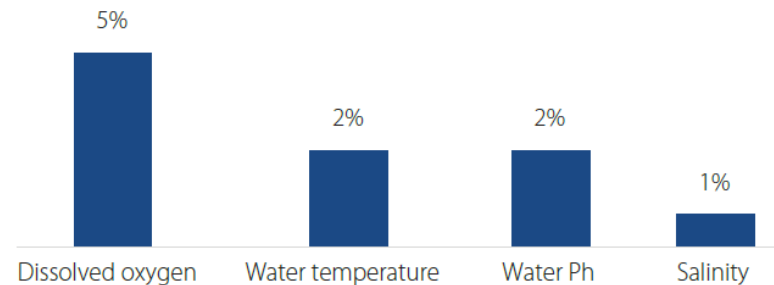
Do you monitor the quality of water in this pond? (% Yes)



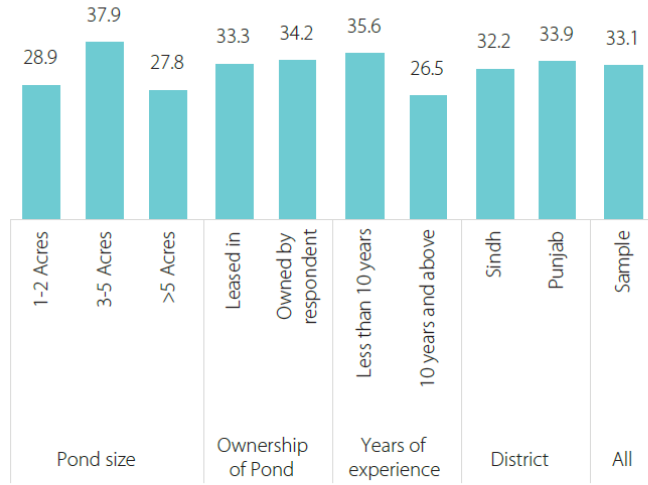
Salinity level



Which water quality parameters do you monitor?

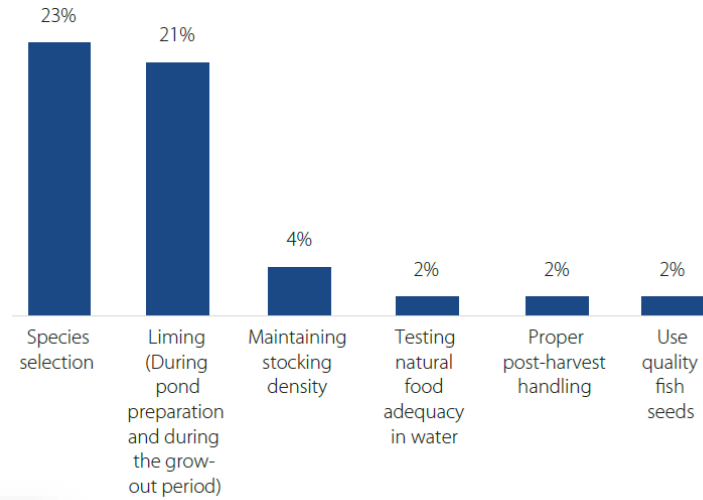


# Management practices

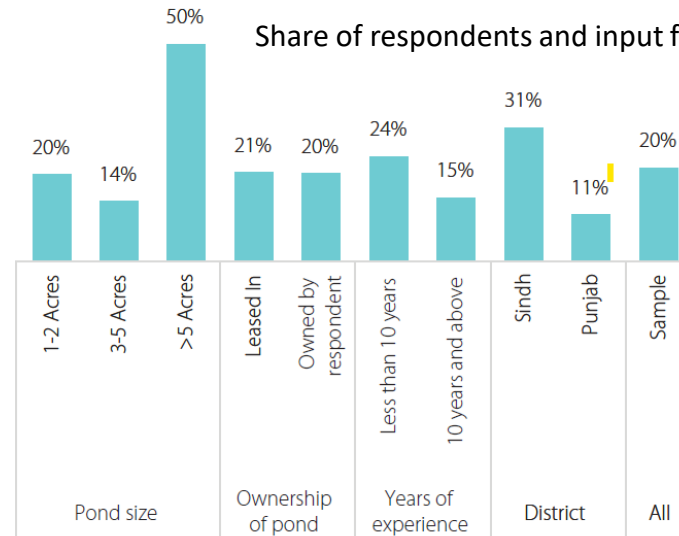


■ Is there any special management practice implemented for pond? (% Yes)

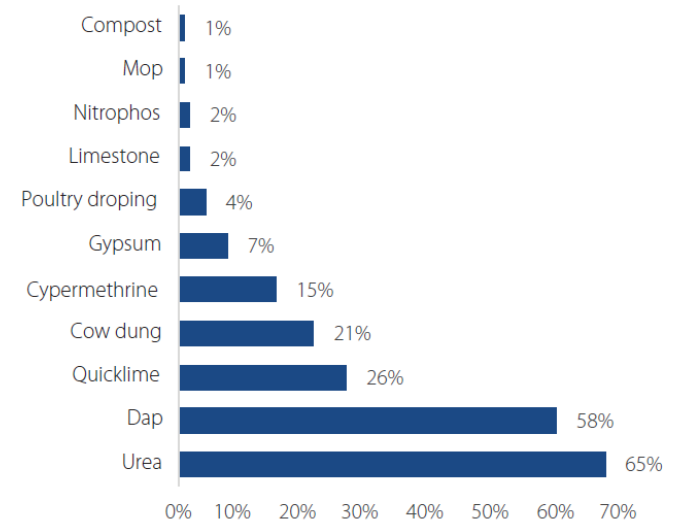
Special management practice implemented for pond



Share of respondents and input fertilization.

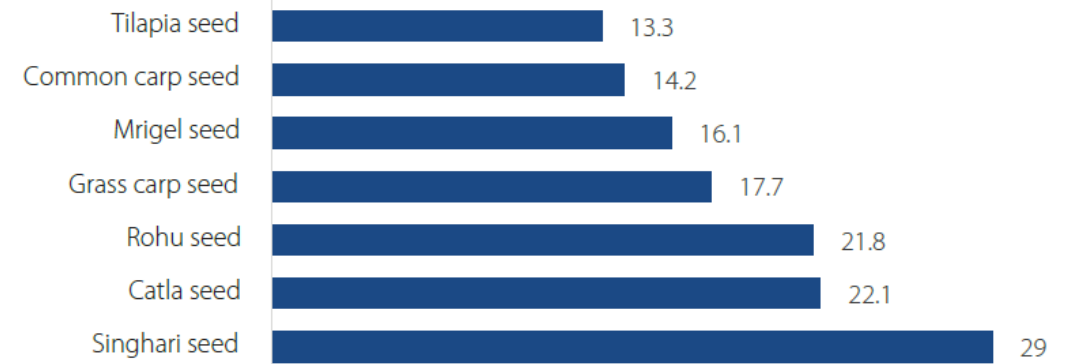
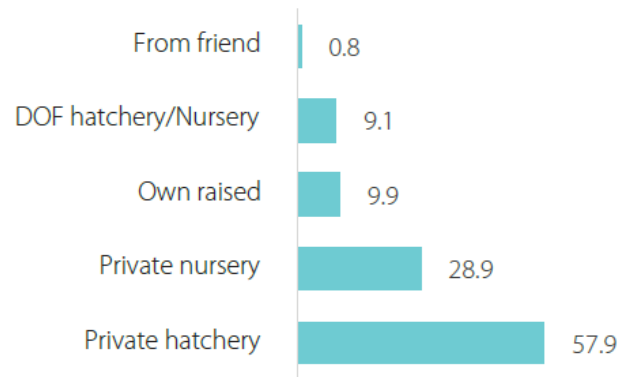
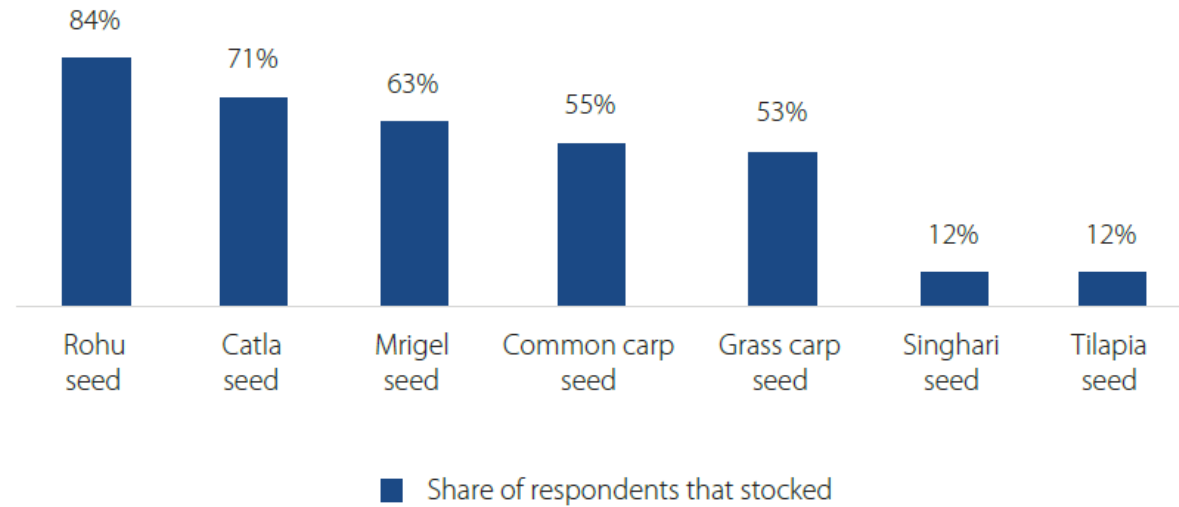


■ Is there any special management practice implemented for pond? (% Yes)



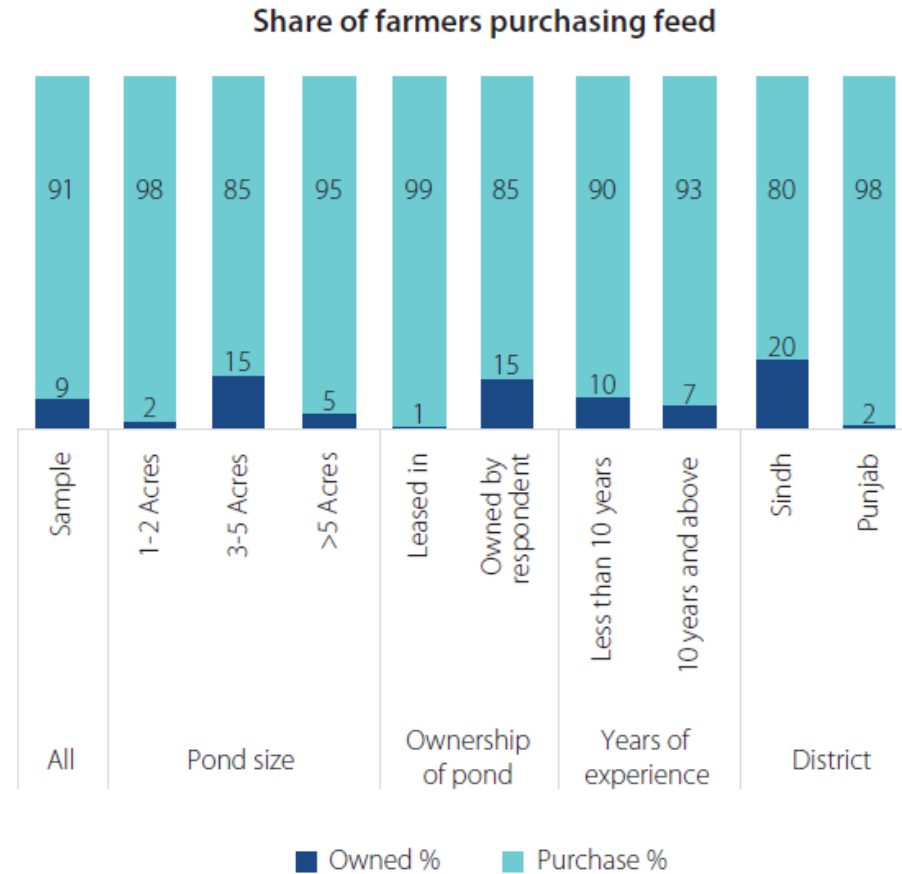
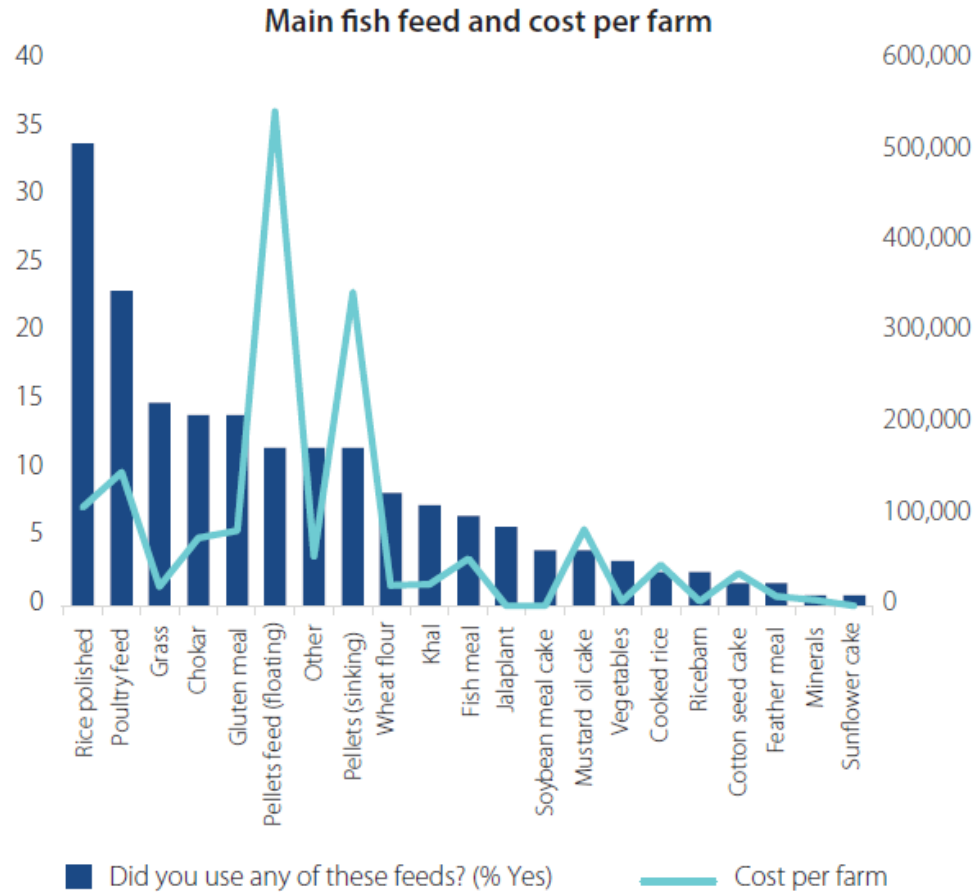
■ Did you use any of these inputs? (% Yes)

# Pond stocking practices





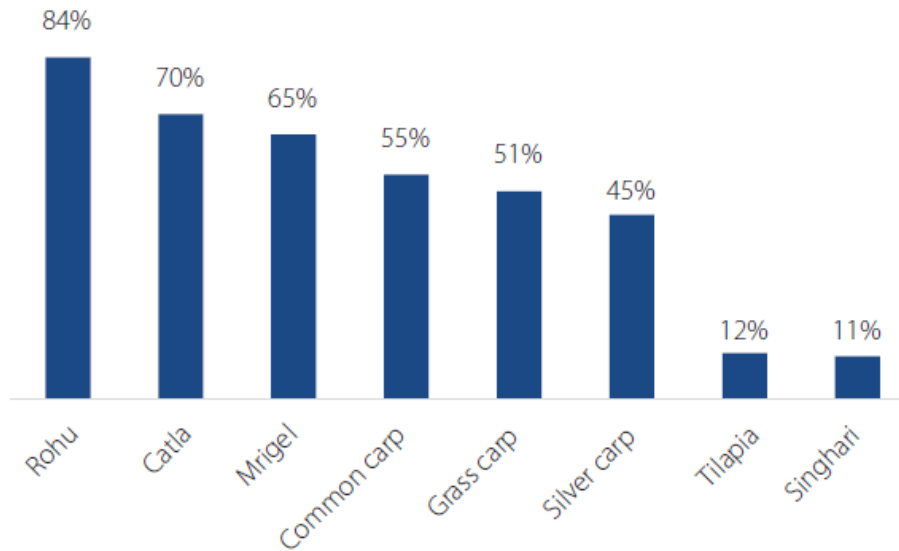
# Fish feeds and feeding strategy



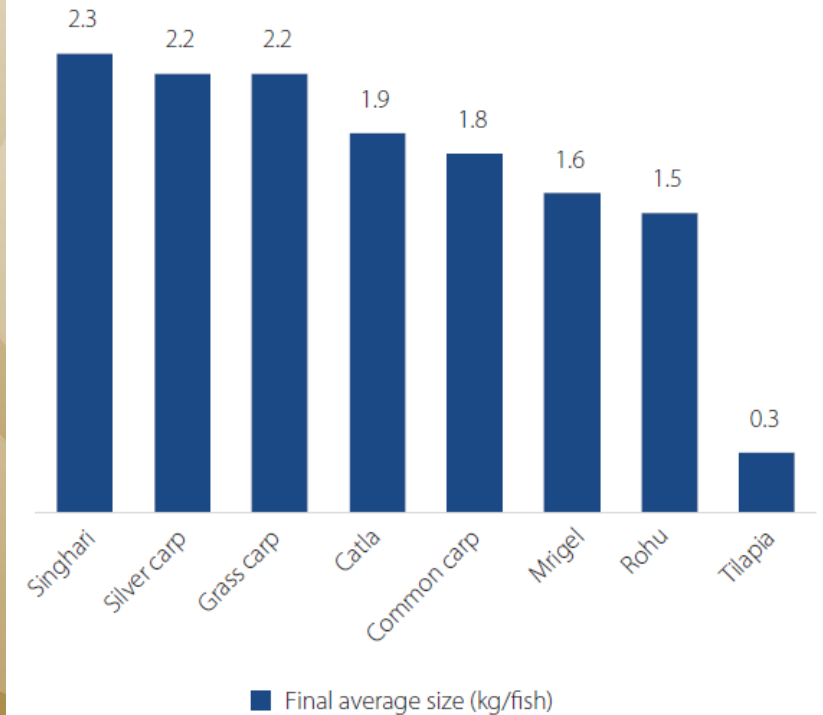
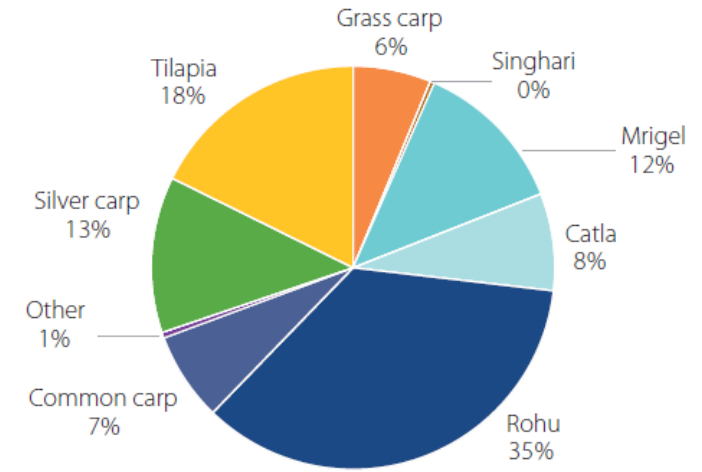
# Fish harvest and average size



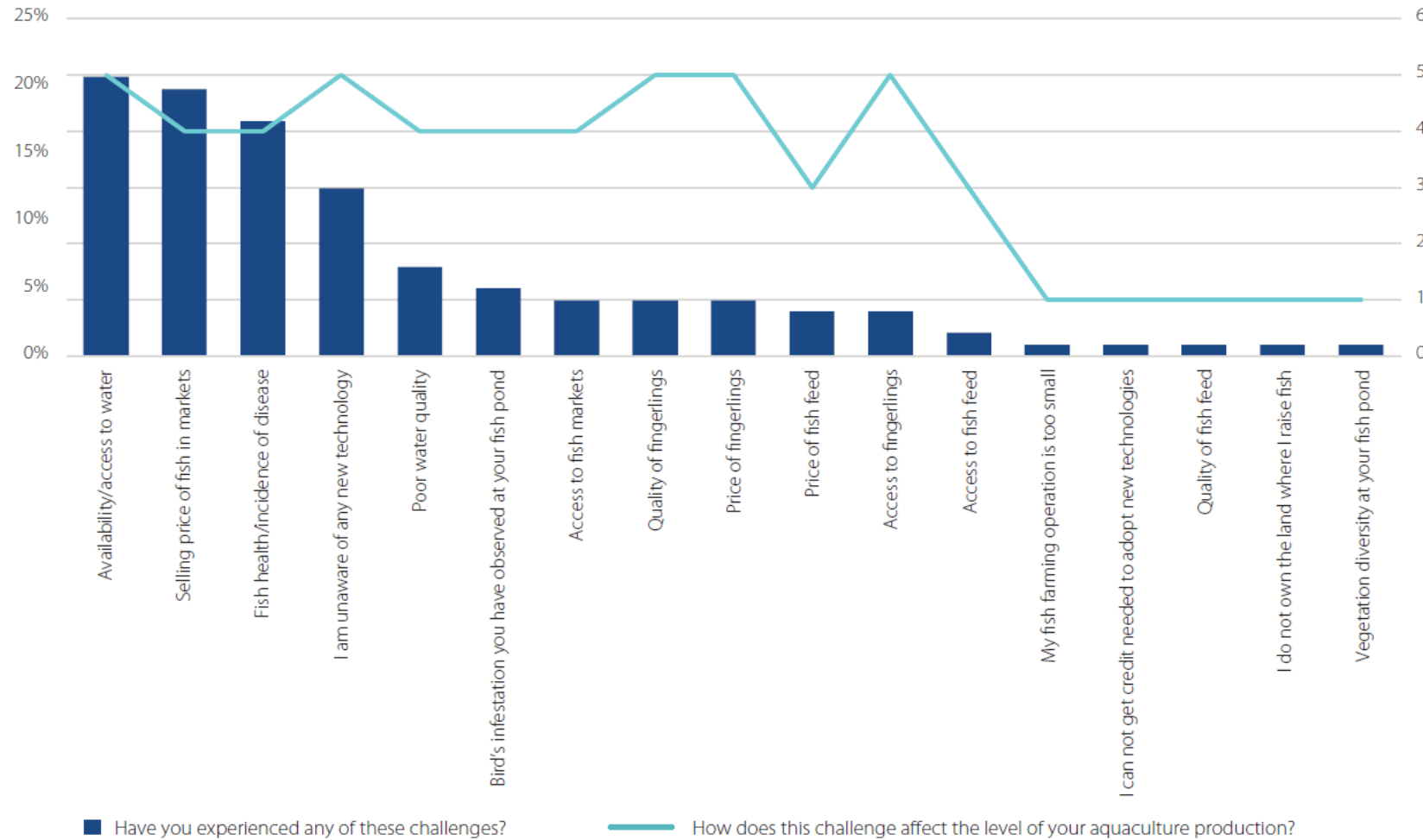
Proportion of farms harvesting key species



Share of fish species by quantity harvested (all farms)



# Major challenges reported



NB: The second question – how this challenge affects the level of aquaculture production is scored using Likert scale of 1=Very low, 2=Low, 3=Medium/Average, 4=High, 5=Very high

# In conclusion

- This study presents an overview of the production system of saline aquaculture in Punjab and Sindh provinces of Pakistan. It aims to develop a shared understanding of its constraints and investment needs for its development.
- **The study also helps to fill the gaps in data and information to support the sustainable development of aquaculture in Pakistan and release its potential for nutrition, poverty and food security.**
- Saline aquaculture plays many roles for many of the respondents, including providing an alternative source of livelihood to farmers whose land is not suitable for agriculture. It also provides fish for direct consumption and soil nourishment because of irrigation.
- Despite its potential, the production of saline aquaculture is very low and limited to a few species. Saline aquaculture in the two provinces is dominated by carp, along with tilapia in smaller quantities.
- Several challenges requiring investment needs were identified, including **limited consumption of fish, high cost of feed and seeds, lack of fresh water, poor technical knowledge, challenges with post-harvest handling, and poor sanitary conditions.**
- Several investment opportunities were identified, including a need for the **development of species tolerant to temperature and salinity variation.**



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