We study finite mixture models (FMMs) under different rank based sampling (RBS) designs. The RBSs as cost-effective designs are used in situations where measuring the variable of interest is difficult (e.g. time-consuming and/or destructive); however, rank information about sampling units can be obtained easily. We first study the problem of maximum likelihood estimation using RBS data for a general class of FMMs. Due to the structures of RBS data, different missing mechanisms are developed to handle rank information and missing memberships. Moreover, we propose new model-based classification criteria based on RBS designs. We show estimation and classification procedures for FMMs based on RBS data substantially outperform their counterparts based on commonly used simple random sampling. The proposed methods are then applied to a fishery survey to study the age structure of Spot as a short-lived fish species based on length frequency data. Finally, we discuss other related topics e.g., finite mixture modeling with order statistics and etc.