This study aimed to evaluate the osteometric boundaries of the ilium, fibula, and scapula beyond which reconstruction of oromandibular and craniofacial defects, using these free flaps, may not be optimal. Fibula, scapula, and iliac bones were obtained bilaterally from 33 female and 27 male European adult cadavers (n = 60). Adapting classical anthropometric methods to surgical needs by modifying the measuring bone localizations and measurement points, a measuring system of osteometry and morphometry was used, to quantify the usable bone length of the iliac crest, fibula, and lateral border of the scapula and to localize an oval region (OR) in the ilium. The thin, translucent OR of ilium was localized 6.24 ± 5.6 cm posterior to the maximum concavity between the anterior superior (ASIS) and anterior inferior iliac spine and 2.67 ± 6.0 cm caudal to the intermediate line of the iliac crest. The available iliac crest was measured from ASIS to the posterior superior iliac spine (PSIS) 24.75 ± 12.6 cm, fibula supplied 17.02 ± 19.1 cm harvestable bone, and the lateral border of the scapula 9.43 ± 8.5 cm. The OR influenced the harvestable bone shape and volume of the ilium. Measuring of the localization points of OR, we found that the size of the OR was very variable and that the height of the neomandible reconstructed with iliac crest might alter with aging. Our findings contribute with knowledge of detailed morphometric measurements on commonly used donor bones to the planning strategies of volumetric defects in oral and maxillofacial region by precise osteometric localization method of OR and relativized length measurements.