The Sea of the Hebrides is an island-studded region of complex bathymetry on the UK continental shelf, west of the Scottish mainland. An extensive area (2200 km2) of recently collected multibeam bathymetry data, combined with seismic reflection profiles reveal this part of the shelf to have been extensively modified by both glacial and modern processes. Our new geomorphological evidence strongly supports the contention that an ice stream drained ice from western Scotland and the Inner Hebrides towards the Barra Fan at the continental shelf break at the height of the last glaciation (Marine Isotope Stage 2–3). Convergent seabed glacial lineations and other subglacially streamlined features eroded in bedrock around the Islands of Canna and Rum preserve the direction of ice sheet movement, and strongly suggest the onset of ice streaming in a southwesterly direction on the continental shelf in the Sea of the Hebrides region. This fast-flow zone formed part of a larger convergent ice stream system draining much of western Scotland and the north of Ireland — the southern part of which has been postulated already. A number of rock basins, linear troughs and deeps west and south of Muck, kept sediment-free by the dominant modern tidal regime, are interpreted as being at least partly subglacial in origin. Similarly, a large complex of buried deeps between Eigg and Arisaig are interpreted as an overdeepened glacial drainage network. It is suggested that intense bedrock erosion by focused subglacial abrasion and subglacial meltwater discharge over multiple glacial advance and decay cycles led to significant modifications of the pre-Quaternary bedrock surface. Other features such as moraines are only found in shallower water (typically < 50 m), west of Canna, west of Rum and south of Skye. Their relative paucity indicates that the modern tidally dominated environment of the area may have removed much of the localised geomorphological evidence of offshore glacial limits within the Sea of the Hebrides, or alternatively that the ice sheet margin was floating and retreated predominantly by calving leaving little geomorphological evidence of its retreat