Cooked mussel flesh is a highly perishable food with a few commercialization alternatives. The development of new products with high quality and added value is of great importance for the mussel industry. Thus, the aim of this work was to study the freeze-drying process of cooked mussel flesh. An experimental device that allows the on-line determination of sample weight and temperature as well as the control of the sample-holder plate heating was developed. Batches of 120 g of samples were frozen (-60°C) and immediately transferred to the freeze-dryer chamber. Then, drying curves were obtained with the temperature of the sample-holder plate controlled at 15, 30 and 40°C and with the heating system switched off. To obtain a moisture content of 10%, the drying time was of 11.3, 10.4 and 9.3 h at plate temperatures of 15, 30, and 40°C, respectively. When the heating system was switched off, the drying time was of 15.1 h. Four characteristic drying periods were identified on the drying curve, each one with a given drying rate. The influence of the plate temperature was more significant in the first two drying periods than in the last two periods. When the temperatures were controlled at 30 and 40°C the product presented a darkening due to the contact with the plate. In contrast, a mild plate heating (15°C) caused an increase of the drying rate without modifying the samples aspect. Moreover, the developed experimental device provided a very good reproducibility in the studied conditions.