8.15. Let $\mathscr{F}_n^0 = \sigma(\{X_i\}_{i=1}^n)$ to find that a.s.,

$$\mathrm{E}\left[M_{n+1}(t) \,\middle|\, \mathscr{F}_n^0\right] = \frac{e^{tS_n}\mathrm{E}\left[e^{tX_{n+1}}\right]}{\prod_{k=1}^{n+1} h_k(t)} = M_n(t).$$

Thus, $\{M_n(t)\}_{n=1}^{\infty}$ is indeed a mean-one $\mathscr{F}^0$-martingale. The second part follows from the first and independence.