# State-space Models (SSMs)

State-space models (SSMs) are useful in better predicting "true" values of a time series. They work by using simulations to make estimates through process and measurement equations. They are useful for inferring better tracks and hidden processes (i.e. behaviour), particularly when using less accurate data (e.g. Argos locations) and/or in the marine environment. A major limitation of using them is that they are hard to validate. Dr. Marie Auger-Méthé has recorded a helpful seminar ([https://www.youtube.com/watch?v=iS5xzcmhpW0](https://aus01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DiS5xzcmhpW0&data=04%7C01%7Cemily.webster1%40my.jcu.edu.au%7C0bf705ab6c6d4f2167b208d9637f4cc3%7C2eba4cf8af764db3bcaf81b5592535ef%7C0%7C0%7C637650220668582269%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=jBb8lmO5RWzmG8rZJKmmRTZA075GiTda6s3Go5Yeinc%3D&reserved=0)) and written a review that is especially targeted towards students wanting to use SSMs: "A guide to state-space modeling of ecological time series" (Auger-Méthé et al. 2021, [https://arxiv.org/abs/2002.02001](https://aus01.safelinks.protection.outlook.com/?url=https%3A%2F%2Farxiv.org%2Fabs%2F2002.02001&data=04%7C01%7Cemily.webster1%40my.jcu.edu.au%7C0bf705ab6c6d4f2167b208d9637f4cc3%7C2eba4cf8af764db3bcaf81b5592535ef%7C0%7C0%7C637650220668587247%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=0u%2Bypq6ympXAUGlHUTNHs5d3C2gNaFgYb38MnR7yhZ0%3D&reserved=0)). There are R tutorials included on how to fit SSMs and validate these models (our tutorial worked through Appendix 1).