

The Early Life of Seabirds: Tracking Juvenile Frigatebirds in the Indian Ocean



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The juvenile phase remains a black box in our knowledge of the life history of animals. Yet these young animals constitute the future of populations, often have a wide dispersive behavior, and have the potential to emigrate and colonize new environments. Typically, mortality is high in offspring when they become independent of parents, probably because of poorer foraging performances. Improving our knowledge on this poorly known age class is a priority if one wants to make predictions on the future of animals in the context of climate change and human impact on ecosystems. Tracking juvenile phases is extremely difficult because individuals are small, have high mortality, and often disperse over wide areas. This is particularly the case in the marine environment. Over the past five years, we developed a program named EARLYLIFE, funded by the European Research Council, aimed at studying the juvenile phase of seabirds and seals over the world's oceans. Here I present results obtained on one of our study models, the great frigatebirds.

Among seabirds, frigatebirds are extreme in many aspects of their life history. First, their plumage is not waterproof and thus they cannot land at the sea surface, although they feed exclusively at sea, especially on flying fish that they catch on the wing. They have the lowest wing loading of any bird that provides them unique capacity for soaring flight using air currents. This capacity allows them to fly at extremely low costs, without landing or resting on the sea surface and thus travel over thousands of kilometers. We studied the dispersive movements of juvenile frigatebirds from several sites, including Europa Island in the Mozambique Channel, but also from the Galápagos and several sites around New Caledonia. A total of 55 juveniles were equipped with 9.5g Solar PTTs, and with 22g Solar Argos/GPS PTTs; the PTTs were attached with tape on the back feathers. The results from the Europa birds were particularly surprising. Indeed we found that juvenile great frigatebirds dispersed over the entire Indian Ocean. After an initial northward movement, they passed-by the Seychelles Islands and then circled the equatorial zone between the Seychelles and Indonesia. During the two first years of their lives



Juvenile frigatebird in flight. Photo by Henri Weimerskirch



Henri Weimerskirch with frigatebird. Photo by Henri Weimerskirch

after becoming independent of their parents, they make loops around the equator by staying aloft for months, and make very short stops on isolated islands, but only for a few hours, before resuming their flight (see map).

That young, inexperienced frigatebirds stay aloft for months was a complete surprise for us. By superimposing the tracks of young frigatebirds to wind data, we found that the birds were circling the doldrum zone, a zone around the equator where winds are weak, often absent, and that were feared by ancient sailing boats because of the risk of being trapped there for weeks. Frigatebirds circle the edge of doldrums where they find a belt of winds that they follow. The equator is also a zone of strong convection that frigatebirds use to take altitude under cumulus clouds by soaring, before making long gliding descents over kilometers. Thus, by using winds for their horizontal movements, and thermals for climbing at altitudes reaching 4000 m, frigatebirds are



Large-scale movement of juvenile frigatebirds around the equatorial Indian Ocean.

able to stay aloft for months at low energetic costs. Such extraordinary performances pose a suite of new questions about navigation, foraging for food and sleep, all these having to be realized in flight. An additional challenge for the bird is that they are exactly in the zone of the formation of cyclones in the Indian Ocean. From January–March, powerful cyclones form south of the equator exactly in the zone used by frigatebirds. Our tracking data show they are able to avoid the cyclones by staying away from the center of the cyclone by climbing at 1000–2000 m and staying at this altitude using a circling rapid movement that brings them at speeds reaching 80–100 km/h away from the gale winds and heavy rains.

After this dispersive phase, young immatures will settle regularly on remote islands to roost, still making long loops over the entire ocean. At the age of 7–10 years, they will return to their birthplace to breed.

Weimerskirch H., Bishop C.M., Jeanniard-du-Dot T., Prudor A. & Sachs G. 2016. Frigate birds track atmospheric conditions over months-long trans-oceanic flights. **Science** 353: 74–78