WHY DON'T RED-BILLED TROPICBIRDS NEST ON MARTHA'S VINEYARD?

by Richard R. Veit

In September of 1986 a Red-billed Tropicbird was discovered flying about the Gay Head cliffs on the island of Martha's Vineyard (Arvidson 1986, Rosenwald 1986, Jones 1987). This spectacular tropical seabird predictably drew hundreds of birders and other wildlife admirers who watched and photographed it for the eight weeks that it remained. Many of those birders with whom I discussed the Martha's Vineyard tropicbird had the common reaction expressed by one of them as, "Man, was that bird ever lost!" But was this particular tropicbird lost at all? This is a question I would like to explore.

I would like to examine why it is that many birders and ornithologists assume automatically that a bird that appears far outside of its normal range must have made a major navigational error. I think there are two components of the reasoning that leads to this conclusion. One is the observation that Red-billed Tropicbirds appear in Massachusetts only at infrequent intervals: therefore, individuals that do so must be "abnormal." The other component involves our human perception of the great physical difficulty involved in traveling from the Caribbean to New England under one's own steam. Because such a feat would be extremely difficult for a human, it must therefore be extraordinarily difficult for a tropicbird.

Extending this line of reasoning leads to two conclusions. Since tropicbirds appear as vagrants in New England infrequently, these occurrences must be unimportant, and if traveling from the Caribbean to New England represents a great physical hardship for a tropicbird, then there must be strong selection against such behavior.

In this article I would like to postulate that long-distance vagrancy is a normal and adaptive behavior of tropicbirds and is of fundamental importance in their life history, despite its relatively infrequent occurrence. In support of this premise, I shall examine just how difficult it is for a tropicbird to fly from the Virgin Islands to Massachusetts, and finally, provide a possible explanation for the fact that tropicbirds do not nest on the cliffs at Martha's Vineyard.

Ornithologists know very little about the causes of long-distance vagrancy, although its significance is belittled because it does not happen very often and seems to involve only a few members of any given bird species -- not very good reasons for dismissing its importance. After all, Darwin's theory of natural selection (now doctrine) was pooh-poohed for sixty years, because many biologists could not conceive of the vast lengths of time required for the proposed process to occur. That is, Darwinian evolution takes place on a time

scale that is very different from the time scale of human lifetimes. I believe that the significance of vagrancy is underestimated for similar reasons.

It is interesting to speculate why it may be advantageous for a tropicbird to travel to Massachusetts. During such speculation, it is critical to compare the disadvantages of dispersing with those of remaining at home. Too often we suppose that a certain behavior will be selected against because it is dangerous, without considering the dangers inherent in alternative behaviors. For example, if a bird is **likely** to perish during dispersal, it could still be to that bird's advantage to disperse -- if the bird is **certain** to perish by remaining in place.

One possible cause of vagrancy might be a dramatic reduction in the amount of some resource essential to survival within the bird's normal range. This is presumably what happens immediately prior to southward irruptions of northern owls or winter finches. In this sort of scenario vagrancy occurs as an emergency measure, an attempt to avoid starvation. On the other hand, vagrancy might be a beneficial option long before resource availability reaches a critically low level. In the case of many seabirds that do not breed until they are several years old, there are advantages to spending their prebreeding years searching for the best possible place to nest; so why shouldn't they? In order to withstand such a long-distance voyage, a bird must eat enough food to lay down reserves of subcutaneous fat, just as a long-distance migrant does. Therefore, in this situation, birds can only afford long-distance dispersal **when food is abundant** -- the complete reverse of the previous scenario. There is some evidence for this: Grant (1978) has found that voles initiate dispersal at times when food supply greatly exceeds the needs of the population, which suggests that dispersal in that instance is a positive venture.

Observations of vagrancy patterns of a wide variety of species of birds reveals that there is a great range in the frequency with which vagrancy occurs. Great Gray Owls seem to move south in large numbers once every eighty years or so, whereas several species of eastern North American warblers appear in California **every** fall, although in varying numbers from year to year. Red-billed Tropicbirds seem to fall somewhere between these extremes, with four New England records in fifteen years.

The **sighting** of a Red-billed Tropicbird in Massachusetts is a rare event, but is their **occurrence** equally rare? It is important to note the sighting of a Red-billed Tropicbird in Maine at about the same time as the Vineyard occurrence. I feel that the likelihood that the two sightings involved the same bird is remote. (I'll bet that a hundred Red-billed Tropicbirds could be released along the New England coast in such a way that not a single one would be seen. Recall the Spotted Redshank of July 28, 1981, that was photographed on Plum Island, yet was not seen by a single Massachusetts birder.) The occurrence of two vagrant individuals of a single species during the same year strongly

suggests that vagrancy is reflective of population dynamics, rather than of haphazard navigational errors. From the pattern of Red-billed Tropicbird vagrancy to the northeast, we may surmise that conditions within its tropical range are only conducive to vagrancy in certain years. Perhaps those are years when exceptional numbers of young are raised (an abundant food supply might have this effect), or perhaps they are years when a massive failure of the food supply occurs. Who knows? The main point of my argument is that just because Red-billed Tropicbirds are not seen in Massachusetts every year does not mean that vagrancy is not a regular aspect of their life history or that it has not been critical in shaping their current world distribution.

Vagrancy is frequently thought of as a maladaptive behavior in birds because it is supposed that vagrants either die or are unable to return to a location where they might successfully breed. I don't believe these suppositions are generally true. Naturally, many vagrant individuals have proved to be underweight, but this is an inevitable consequence of having just completed a lengthy flight. In the case of the Martha's Vineyard tropicbird (apparently in the pink of condition), what was to prevent it from flying right back to the Caribbean at the end of its Vineyard stay?

Let us now consider the sophistication of a bird's navigational system. Imagine yourself a Wilson's Storm-Petrel pattering over the surface of the waves on Stellwagen Bank. At six inches above the water, the horizon is on the order of a few hundred yards away, yet you will have to find, when breeding season approaches, some particular crevice in a rock, perhaps two inches across, a good **12,000 miles away on the Antarctic continent**. Consider that you are unlikely to have any view of the sun or stars for the last 1500 miles of the voyage and that fog or rain will likely preclude any view of the shoreline until you are within a hundred yards of your nest.

We should remember also the G. V. T. Matthews' Manx Shearwaters taken from their nests off Wales and released at Logan Airport to be found back on their nests 12.5 days later. My point is that in order for seabirds to navigate that well, their perception of the world must be dramatically different from ours, and it is therefore inappropriate for us to judge the likelihood of a bird navigating from point A to point B by what **we** think is difficult.

How much energy is required for a Red-billed Tropicbird to fly to Massachusetts from the Caribbean? I have attempted to calculate this based on equations provided in Pennycuick (1974) and Bartholomew (1982). Using Pennycuick's equations 12 and 13, I find a maximum range speed of 4.23 meters/second (about 10 mph) and a maximum range power of 20.28 watts. These values represent the speed at which a 750-gram tropicbird should fly to cover the maximum distance per unit of energy expended and the rate at which energy would be expended at that speed. By burning only subcutaneous fat (i.e.,

not stopping to feed), the tropicbird could cover 625 kilometers on 75 grams of fat, or 10 percent of its body mass. As birds are able to carry up to an additional 50 percent of their body mass as fat, it would seem reasonable to suppose that a tropicbird could lay down the 300 grams of fat required to fly the 2600 kilometers from the Virgin Islands to Massachusetts. Of course, the Gulf Stream approaches to within about 150 miles of Martha's Vineyard; so it seems likely that a tropicbird could manage to feed during some daylight hours on the voyage and would therefore require only modest fat reserves.

This estimation of flying range is probably a conservative one. For example, I think tropicbirds fly faster than the theoretical maximum range velocity of 4.23 meters per second. Laughing Gulls, approximately the same size as Red-billed Tropicbirds, have been shown to fly at almost three times this velocity at only a 20 percent increased rate of power. This suggests that a tropicbird could cover a greater range per gram of fat burned than I have estimated. Thus, so long as the tropicbird is not tied to a particular location, such as a nest site, why shouldn't it travel in search of areas where it might find a more suitable breeding site with fewer competing tropicbirds?

This now brings me to my last point. Why do we not have tropicbirds nesting at Gay Head? Answering this sort of question --What limits the distribution of a particular species of animal or plant? -- is one of the most important and difficult aims of ecology, and I certainly cannot hope to answer the question for tropicbirds in Massachusetts, but I can speculate. Perhaps there is not enough food for them off Gay Head or perhaps the cliffs are too crumbly for nesting. Yet there have been at least six Red-billed Tropicbirds in the western North Atlantic north of Long Island in the last twenty-five years. Martha's Vineyard has been at its present location in more or less its present shape for at least five thousand years. This suggests to me that perhaps a more substantial number of Red-billed Tropicbirds must have scanned the multicolored cliffs of Gay Head with a critical gaze in years gone by but have decided that these cliffs just would not do.

REFERENCES

Arvidson, D. R. 1986. "Another Massachusetts First: Red-billed Tropicbird." *Bird Observer* 14: 241-243.

Bartholomew, G. 1982. "Energy Metabolism." In *Animal Physiology, Principles and Adaptations*, 4th ed., edited by M. S. Gordon et al. New York: Macmillan.

Grant, P. R. 1978. "Dispersal in Relation to Carrying Capacity." *Proc. Nat. Acad. Sci.* 75: 2854-2858.

Jones, K. 1986. "Red-billed Tropicbird in New England." *Bird Observer* 14: 281-282.

Pennycuick, C. J. 1975. "Mechanics of Flight." In *Avian Biology*, Vol. 5, edited by D. C. Farner and J. R. King. New York: Academic Press.
Rosenwald, J., II. 1986. "How About That Tail?" *Bird Observer* 14: 238-240.

RICHARD R. VEIT, a former records compiler for *Bird Observer*, is working on his doctorate in ecology and evolutionary biology at the University of California, Irvine. He has published several papers and produced for his master's thesis at the University of Massachusetts *The Birds of Massachusetts* (awaiting publication). His field of specialization is spatial dispersion patterns of Antarctic seabirds.