A response to Dr. Rob Fergus and his "weighing in on ultrasound bird control devices as nesting season approaches."

From:
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In his on-line publication listed above, Dr. Fergus repeatedly states that:

> *Birds hear the same level as humans.*
>
> *Birds don't hear ultrasound.*
>
> *The bottom line is that birds cannot hear ultrasound frequencies and the ultrasonic devices don't work.*
>
> *In the most recent tests, no birds have been shown to hear frequencies above 20 kHz. For this reason, ultrasonic devices using frequencies between 15 and 30 kHz are completely ineffective save for a few song birds.*

Where does one begin to refute such a diatribe?

I'm inclined to begin with a quote from Mark Twain that I usually present to my students in the first days of my animal behavior class.

> *The notion that the truth can be sought in books is still widely prevalent, and the present dearth of illiterate men constitutes a serious menace to the advancement of knowledge.*

I then explain to the students that this means that if we blindly accept what we read to be true, there is no chance that we can change our understanding of the world or find out what is true and what isn't. We must ask questions and test the limits of our knowledge or we can not advance it. This is especially true regarding our accepted "knowledge" of ultrasound.

Sadly, much of what is in text books and other references is erroneous. Even more egregious is the fact that even when science disproves errors in books, they continue to be quoted as stated in the original writing in future publications. Thus the misinformation goes forward long after it should have been corrected.

That said, let us correct and comment upon Dr. Fergus' assertions that "In the most recent tests, no birds have been shown to hear frequencies above 20 kHz."

According to the Handbook of Bird Biology, Chapter 4. Howard E. Evans and J. B. Heiser, Chapter Eds., 2004 Cornell Lab of Ornithology, p 4.61.

> *Tested hearing range in a series of birds varied from a low of 40 hertz in the budgerigar to a high of 29000 hertz (29kHz) in the chaffinch, a common European bird. Each species, however, appears to have its own distinct range of frequencies to which it is sensitive. Passerines perceive high-frequency sounds better than most non-passerines.*
>
> *Small song birds make and hear sound just above our hearing range to a maximum of 29000 kilohertz.* (p 4.66 same source)

What this strongly suggests is that until recently, it was commonly accepted that birds did not hear into the ultrasonic range and thus few if any were tested properly. If one passerine species of the thousands that exist has recently been shown to hear to 29 kHz, then almost certainly many other closely related species do as well.

Why would such a misconception as assuming they did not hear in this ranges have existed so long? Well, two factors come to mind.

1) Most references re: bird hearing ranges reported in 1995 (The Audubon Society Encyclopedia of North American Birds J. K. Teres. Ed., Wings Books) are pre 1966 in date with 1939 and 1943 being the three most abundant citation dates.

   As Mark Twain suggested, once it was written down in books no one questioned it.

   Why would we accept that so easily? It was common in the early years of biology to express our hidden bias as humans – that we were superior to other species in our senses and all other traits. We were slow to accept that "lower species" see colors we don't, hear sounds we don't, sense gravity and magnetic fields and other forces we do not sense. Our hubris was only part of the problem. We also had equipment to test for hearing and sound production that was designed specifically to make it best for human hearing recording and playback ranges. Almost all recording devices have 20/20 filtering built in, filters that screen out sound below 20 H hz and above 20,000 Hz to improve sound quality in our hearing ranges. Sonographs, the principle device for analyzing bird song in the 1950-80s also had high and low filters to limit detection to the middle frequencies – the primary range of the audible sound spectrum. So, it was not suitable to testing for ultrasound production in birds. It could not disprove our bias. We never asked the proper question with the proper equipment to get the right answers – until very recently. **Now we know some, if not the majority of, birds can hear to 29000 Hz and thus can respond to ultrasound.**

2) Additionally, some aspects of bird acoustics have been little studied. We get a sense of this from a quote from 1996 Ecology and Evolution of Acoustic communication in Birds, D. E. Kroodsma and E. H. Miller, Eds. Comstock/Cornell publications):

   Today data on thresholds for signals masked by broadband noise are available for more than 10 species…in 1982 Dooling could refer to studies of hearing in noise for only a single species.

   Obviously the data base for some areas of studies of bird hearing are limited even today, and that probably includes ultrasound response testing since it has been improperly accepted that birds could not perceive it until very recently.

As a final question for Dr. Rob, are you not familiar with this axiom of science and what it means?

Absence of evidence does not constitute evidence of absence.

If we think about it, especially in the context of responses of birds to ultrasound devices, it only means the correct tests have not been done in the correct manner with proper equipment to answer the question of whether it works.

This means that you cannot say that birds don't respond until you have actually tested it on birds. They may hear it, but can they respond even if it is out of their hearing range?

At least one recent and reputable source supports the idea that they it can:

Some bird species are apparently able to perceive ultrasound, although whether they actually "hear" it with their ears or detect it in some other way is unknown.

(Page 4.61, Handbook of Bird Biology Howard E. Evans and J. B. Heiser Eds., 2004, Cornell Lab of Ornithology. Note that this is the premier international resource and repository for all our current scientifically accepted knowledge on bird sounds and hearing information.)

Is there scientific evidence that ultrasound can be heard or felt in some other way by birds and possibly does work?

I can say unequivocally, yes, based on my many years research in animal behavior.

I first tested animals for ultrasound hearing in 1980 while a graduate student working on my PhD in animal behavior at UW-Milwaukee. I was told by my Anthropology professor that no primates could hear ultrasound, based on his (baseless) assumption that if they could, we certainly should as their descendents. Funny how that bias slips in there, isn't it? My wildlife and biology background suggested to me that early insectivorous primates should probably be sensitive to the ultrasound of insects, their primary food. I tested it with a silent dog whistle used in the nocturnal animals exhibit of the Milwaukee County Zoo. When blown, dwarf galagos, and slow loris, and even the desert fennec fox all immediately focused on the source of the call, indicating they heard it.

The following 7 years I worked on deciphering the vocal and visual communication of the Giant Canada goose – complete with thousands of hours sonographing calls I had recorded for analysis. About that time I was asked to help devise a means to keep geese out of the approach paths of aircraft landing at St. Paul Minneapolis International Airport.

Goose has striking response to ultrasound in lab testing:

I tried experimenting with geese and a very high tech ultrasound generating device from the UWM sound labs. I brought a goose into the sound lab in a large dog crate and tested it with a burst of 22,000 cs (Hz) sound. I can't tell you whether it could hear that as sound or not, but I can tell you it toppled over instantly and became a rigid mass of flesh. Only the eyelids flickered open and closed. Within a minute of the time the sound stopped, the goose recovered and stood, seemingly unharmed.

I repeated the test several more times after replacing the piezo electric speakers, which had blown. They did this each time I tried the test, and the goose dropped solidly each time with eyelids flickering. The speakers were never meant for use with such high decibel ultrasound. With more research I came to understand that it would be impossible to generate and deliver ultra sound with needed force at the distances necessary to deter geese from aircraft flight paths, and I terminated my research in that area for a while.

What was happening inside the goose? I can only speculate, based on outward appearances, that at that distance and intensity the ultrasound may have affected molecular level channels of nerves and muscle cells, possibly permitting Na+ or K+ channels to open and stay open, interfering with normal muscle and nerve function. Whatever it was, it was a striking response to the sound.

Geese avoid golf green where QB-4 ultrasonic device is in use:

In 2001, I was trying to use Canada goose alarm calls to get geese to leave grass test growth areas at a major lawn seed and fertilizer company in Marysville, Ohio. Thinking back to the early test, as a side test, I tried using a QB-4 ultrasound roughly (30 kHz, 80 db @ .5 m) device on a practice golf green outside the main corporate headquarters. More than a hundred geese and goslings were feeding on this green daily and the droppings were everywhere. Once in place and in use, the area of the green within 25 feet in all directions remained free of droppings, while the rest of the green was more densely covered than ever. Clearly, geese and goslings sensed and reacted to the sounds at some level, whether heard or not. And, they avoided it.

So the question of whether birds can perceive the sound at some level is answered.

Can the devices be efficacious in moving birds away from them? Yes. Absolutely. But, the user must be aware of the range limitations inherent in using ultrasound. The maximum response range I've found in studies with bats, mice, and geese is roughly 50 feet. Beyond that, the energy of the high frequency sound has

dissipated too much to be effective. Does this mean it will not be effective in scaring birds away? Not necessarily.

Placement of the ultrasound unit is a key in success. In mouse tests in my old farm house, use of one ultrasound unit in my back hall, the path for mice to enter the main house from the basement, reduced mice in the house by 100% comparing identical time periods for the two years of the study – 32 mice trapped when the unit was turned off, versus none trapped when it was on. Yet, despite its limited sound range, it protected 800 square feet of house from mice. Similar tests in the garden showed protection of tomatoes from gnawing mice for more than 500 sq. ft. around the unit.

If ultrasound units are placed as near as possible to where birds enter buildings, or in the corners they prefer to occupy, they will be most likely to demonstrate high efficacy at keeping birds out. If used inappropriately, they won't.

Ultrasound units are not functionally able to clear 500 acres of gulls or crows. The sound range they produce does not carry far enough. Only if we accept that ultrasound does have potential to help solve bird problems will we be able to properly determine its abilities and limitations. To find out what it can do, we must do the tests and try it in many different applications. As I continually tell my students:

If we don't do the tests, we can never learn the answers, and we can never advance our knowledge.

Finally, as a counter to Dr. Rob's assertions that there is no proof ultrasound works against birds, we can just as correctly say that there is no good scientifically generated evidence that ultrasound units do not work in the proper locations and following proper parameters of use. And we do, now have irrefutable evidence that many birds can hear or perceive ultrasound.