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SONIC SYSTEMS FOR CONTROLLING BIRD DEPREDATIONS

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ABSTRACT

The sounds used in controlling bird depredations can be classified into three types:

- (1) **AUDIBLE DISTURBING NOISES:** From clapping of hands by primitive peoples to the modern exploding shotgun shells, loud noises have long been used to frighten birds from man's crops. They are still a valuable supplement to other methods or when needed for short, discontinuous periods.
- (2) **ULTRASONICS:** Sounds over 20,000 cps are apparently beyond the limit of birds as well as humans. There is no effective use of ultrasonics in bird control as yet.
- (3) **BIOSONICS:** While song is a more noticeable facet of bird communication, the briefer calls are more important to birds in their everyday living. These calls are classified as: sex and nesting, recognition, food, assembly, distress and alarm. At present, only the last two are being used in bird control. There is less chance of habituation of birds to this type of signal, but limitations and the expensive equipment involved may make it difficult to justify this approach economically.

Sound has been used in attempts to keep birds out of man's crops ever since they and man have disagreed to whom the crops belonged. The first attempts consisted of loud, unnatural noises with the hopes of making the birds too nervous to eat. Tod (1914) mentions the use in India since at least 1300 A.D. of clay mud balls that were thrown by slings into bird flocks. The effectiveness of this was dependent upon the whining noise of the projectile as it hurtled through the flock rather than any hope of knocking birds down. Another ancient method involved watch towers where children of primitive peoples were delegated to shout and clap as the birds settled down for a repast. This has been used by primitive agronomists on all continents (Buttiker, 1961).

As we have advanced technologically so have the use of sounds-from the clapping of hands and banging on drums through chattering windmills and firearms up to the pyrotechnics developed specifically for bird work. In the last-mentioned

category, we include the fuse rope (Neff and Mitchell, 1955), automatic acetylene exploders (Cardinell, 1937), exploding shotgun shells (Zajanc, 1958), air horns (Zajanc, 1964), besides special fireworks like 2-shot aerial pyrotechnics (Fitzwater, 1961).

Thus loud noises by themselves are usually effective if used discontinuously for short periods of time. However, I have seen doves unabashedly searching for food within fifty feet of runways on which F-102's were practicing touch-and-go landings. Studies have shown, though, that loud noises, particularly pyrotechnics, when used to supplement other methods are generally more effective in the combination than either of the methods alone (Brough, 1963).

Another application of sound is the use of ultrasonics. These are sounds above 20,000 cps (cycles per second) that cannot be detected by the human ear. Investigation has shown that most pest bird species' hearing range lies well within the common range of humans as shown below:

<u>Species</u>	<u>Sensitivity to sounds (cps)</u>			<u>Reference</u>
	<u>Low</u>	<u>Optimum</u>	<u>High</u>	
Crow	300	1,000-2,000	8,000	Bremond, 1963
Horned lark	350		7,600	Frings and Slocum, 1958
House sparrow	675		11,500	Frings and Slocum, 1958
Magpie	100	800-1,600	21,000	Bremond, 1963
Pigeon	200	1,000-4,000	7,500	Frings and Slocum, 1958
	300	1,000-2,000		Bremond, 1963
Starling	700	2,000	15,000	Frings and Slocum, 1958
	100	2,000	15,000	Bremond, 1963
			16,000	Frings and Cook, 1964

My personal experiences with several production models of these ultrasonic devices for bird control have been rather discouraging. Though exposure to ultrasonic sounds have been shown to make animals, and humans, uncomfortable so that they would leave an area after being subjected to them for a time, there are several physical limitations acting against their use in bird control. Ultrasonics require costly apparatus to produce, leave sound "shadows" and diminish in intensity very rapidly as they leave the source. While it is possible that they may have application in keeping birds from roosting in areas such as enclosed warehouses, little is being done at present with these in bird control research.

The final type of sound to be considered is that made by the animals themselves. Biosonics or the study of animal communication systems is a new but very promising area of investigation. We are all aware of bird songs and their role in reproduction and territorial expression, but it appears that the briefer, simpler calls used by birds are probably more important in day-to-day living than the more polished songs. These call notes have been typed into the following categories by Burt (1967):

SEX AND NESTING: These are soft calls of a "whistle-while-you-work" nature, usually uttered by females during these activities.

RECOGNITION: As we can distinguish a friend by the sound of his voice, so are birds able to recognize their mates or the young their parents.

FOOD: If an individual bird of a gregarious species like a gull finds a bounteous supply of food, he can emit a chow call that brings others to the table in haste. Of course, if it is only a little bit, he will quietly gobble it down and say nothing.

ASSEMBLY: Rallying calls are used by certain species to unite against a common foe or to aid in keeping a flock together. A good example of this type is the assembly call of crows who have spotted their ancient enemy, the owl, in a vulnerable position.

DISTRESS: The cries of some species held in the hand or the grasp of a predator may have diverse effects on its audience. It may cause some birds to come close to investigate either out of curiosity or the desire to aid the victim or it may warn others away from the area.

ALARM: The reaction to this type of call is to make the other birds leave the area at once. It appears that they are also able to define the cause of the alarm and from where it comes in this call.

While the assembly and food calls have potential value in bringing birds into a given area where other measures may be used against them, only the distress and alarm calls are currently being used in bird control. These were first applied in 1953 when Frings and Jumber (1954) demonstrated that the recorded distress cry of a captive starling would be able to break up the roosting pattern of a wild flock. Considerable progress has been made, particularly in Europe, since the original studies. Recordings of the distress calls of bird species inimical to airfield operations are used on many military and civilian airports in England, France, Germany and Holland (Wright, 1969).

Before the effectiveness and practicality of biosonics in bird control can be established, there are certain basic problems that need further exploration:

NOT ALL SPECIES HAVE ALARM CALLS: While most of the gregarious species have alarm and/or distress calls, some species of birds, notably the pigeons, do not (Boudreau, 1968).

ALARM VERSUS DISTRESS CALLS: Most of the work so far has been done with distress calls. These are much easier to obtain because the "distressed" bird can be held in the hand and forced to emit this call. Alarm signals are given by unconfined individuals, as they sight a predator (Frings and Frings, 1968). As mentioned above, the reaction to alarm calls is for birds within hearing range to leave the area whereas many tend to circle around the source of the distress calls before leaving. It seems probable that the use of alarm calls would be considerably more effective (Schmitt, 1961).

INTERSPECIFICITY: The response to calls is apparently partly inborn and partly learned. Frings and Frings (1963) found that an apparent dialect problem was

nothing more than a matter of association. Broadcasts of French crow alarm calls to a group in Maine got no reaction. When this demonstration was repeated to another group of crows in the same area, there was a reaction. It was later concluded that the first group were resident crows whereas the second group were migrants who spent their winters in Florida associating with fish crows whose alarm calls resemble those of the French crows. Bureau of Sport Fisheries and Wildlife personnel (Pearson, Skon and Corner, 1963) found that the distress call of an immature yellow-headed blackbird was better for moving redwing flocks than calls by redwings. This, of course, may possibly be another case of individual variation. Improved analyses of bird calls will undoubtedly be fruitful in designing calls that will affect a wider spectrum of species.

INDIVIDUAL VARIATIONS: Birds have individual voices that may get different results. European workers (Bremond, *et al*, 1968) found that out when they tested one proven jay call against another made with superior recording equipment. The reaction to the first was 100 per cent compared to only 82.4 percent in the one recorded with apparently higher fidelity. They concluded that the call by individual jays varied in their ability of getting the message across. In this area we must also consider that response thresholds will vary with local conditions. At very high levels, birds are sometimes reluctant to respond to any stimuli apparently figuring that if it sounds that bad they are better off staying put.

REPRODUCTION FIDELITY OF CALLS: Frings and Frings (1963) stress that calls must be of sufficient fidelity to get the message across. Other workers (Bremond, *et al*, 1968) found that fidelity was important with unfavorable winds but not necessarily so with regard to other factors:

<u>Influencing factors</u>	<u>Percentage of trials effective</u>	
	<u>Low fidelity</u>	<u>High fidelity</u>
Favorable winds	100.0	93.75
Cross winds	79.1	88.0
Opposing winds	47.8	84.0
Strong winds	65.4	88.5
Masking background noises	60.0	63.6

The importance of fidelity in broadcasting calls is not clear to me. However, let me preface this discussion with the statement that one who is so tone deaf that he only recognizes the Star-Spangled Banner because everybody stands up is not the best qualified to pass on tonal fidelity. In the taped and simulated calls used by growers in California, I find it difficult to feel that a bird would recognize them for what they are supposed to be. I question the tonal fidelity obtained by one grower in San Jose who claimed to have gotten good protection with a homemade broadcasting outfit using 6 speakers and a continuous tape on a 7-acre cherry orchard. He "stole" his tape by field recording the sounds on a professionally-made tape. He did admit interspersing the house finch alarm notes with rock and roll music and a recorded fight between his dog and parrot which might open up a whole new approach.

ATTRACTION AND NEED OF THE BIRDS FOR A GIVEN AREA: It stands to reason that the chances of driving out a migrant flock just passing through are considerably better than dislodging a resident flock who consider it a deeded nesting, roosting, feeding or loafing home site. So the success of biosonics must be evaluated in terms of the strength of the attraction drawing the birds into the area. Also the existence or lack of substitute facilities within range is important in judging the success of methods used to drive the birds out.

TIMING: Timing is also important. It is much easier to break up a habit pattern such as birds feeding in a given field before the habit becomes imprinted by applying control tactics in the first stages of the invasion. Therefore, biosonics will be more enhanced by their application at the start of a damage period rather than later on.

ASSOCIATION OF THE CALLS WITH OTHER DANGER STIMULI: While habituation to a natural call is felt to be minimal (Fring and Frings, 1968), it does occur (Brown, 1961). And, as Wright (1969) has pointed out, birds can habituate to almost any situation that is not genuinely hazardous. Therefore, broadcasting alarm calls without additional reinforcing stimuli loses its effectiveness with time. In one of my first attempts with a homemade tape on a starling roost in Euclid, Ohio, I noted that as the distress cries were broadcast at them, the birds became restless but would not leave the roost until a sharp clang made by dropping a hammer on a piece of tin caused them to move away enmasse. The use of a detonation preceding distress calls has also been recommended by Keller (1967). The combination of two stimuli (distress cry and pyrotechnics) is much more effective on airports (Brough, 1968):

<u>Species</u>	<u>Tape Alone</u>	<u>Tape and Shellcracker</u>	<u>Shellcracker Alone</u>
Gulls	85%	92%	62%
Corvids	93%	94%	86%
Starlings	57%	94%	93%
Lapwings	71%	90%	73%

The percentages above indicate the ratio of attempts where the results were rated as "good" for removing offending species from airport runways. Busnel and Giban (1968) feel that visual stimuli like dummy cats or raptor forms are needed to give emphasis to distress cries.

SUBLIMINAL EFFECTS: It has been claimed that the repeated use of distress cries on some species may have a subliminal effect (Anon., 1969). Thus birds made subconsciously uneasy during broadcast periods without other stimuli may remain in the area. However, the constant cry of "wolf finally breaks the individual down and he moves on to other pastures. This theory is in direct contradiction to the basic premise that birds do not habituate to supposedly legitimate communication signals. Possibly the biggest problem in bird control is that the field application of the methods is generally delegated to individuals who have no real understanding or interest in the birds they are trying to control. Thus basic to good control projects is the use of trained personnel as shown by the work on military airfields in Britain

(Wright, 1969). A knowledge of the species involved, activity patterns, movements, life requirements, etc. is needed before any control program can be successful.

There are two sound devices commercially available in California. One company provides recorded tapes of the distress cries of various birds while the other electronically stimulates their alarm notes. Field evaluations of these units have been faced with the inevitable lack of cooperation by the birds. However, the following results are reported here with the hope that they will provide more background material in this aspect of bird control.

The machine using linnet-starling distress calls was operated in Ed Pomeroy's cherry orchard (Brentwood, California) for two seasons. Damage was estimated by marking an individual tree limb and removing bird-pecked cherries and culls. At harvest time, all pecked fruit and stems of missing fruit were counted and a ratio obtained to the number of good cherries remaining. The results were as follows:

<u>Feet from machine</u>	<u>Estimated percentage of loss by birds</u>	
	<u>1969</u>	<u>1970</u>
50	3.9	2.4
100	3.5	5.7
150	4.2	13.5
200	-----	-----
250	0.9	-----
Over 250	0	-----

In 1969 the damage was relatively uniform over the orchard indicating no appreciable protection near the machine over the samples taken at the extremities of the orchard. The fact that damage dropped at the outer limits can only be explained by the irritating faculty of birds to upset any type of plot studies. In 1970 there seemed to be a definite correlation between distance from the machine and the amount of damage. The indication of a 13.5% loss at only 150 feet from the machine is not acceptable as an economical or effective control measure. I feel that a cherry crop is a difficult one to protect from birds and that sonics as used at present are not the answer.

The other machine was used in the University of California-Davis vineyards. Two tests are worth mentioning here. In 1969 the machine was set in operation in a long but narrow Thompson seedless varietal block just as damage was commencing on that variety. In the 4 weeks before harvest, weekly records were taken of the individual grapes eaten or pecked by birds on marked vines at various distances from the machine. At harvest an estimate was made on the percentage of grape

Distance (feet)	100	75	0	50	100	150	200	250	300	350	400	Over
Percent damaged	43	10	0	0	0	0	0	6	11	13	36	21

In explanation of these data, the vines to the left of the machine (0 feet) adjoined a walnut grove that was a favorite roost. The other end of the plot ended on a different varietal block of grapes. This rather clearly pointed out that the machine cannot

affectively stop damage near prime habitat. It also indicated that under ideal conditions the effective range of one set of broadcast horns would be somewhat under a 300-foot radius or only 6.5 acres, which I do not feel is an economically feasible control practice.

Also at the University of California-Davis vineyards, a test was conducted on an earlier variety of grapes (Cardinals) in 1970. In this test, individual grapes destroyed by birds were counted at weekly intervals. After the main block was harvested, the machine was removed to another part of the vineyard (though it could still be heard in this block). About a week later, a final count was made of the individual grapes left so that it was felt that the damage estimate in this case represents a reasonably accurate accounting:

Distance (feet)	50	75	100	425	460
Percent damaged at harvest time	7.0	13.7	14.1	66.6	67.7
Percent damaged 1 week after machine had been removed	2.6	2.7	3.0	2.8	3.5
Total percent damaged	9.6	16.4	17.1	69.4	71.2

In this instance, pressure was heavy as these were the first grapes to attain an attractive sugar level in the area. Only a little over a hundred feet on two sides of the machine were in this variety. The longer distances were in separate blocks of Cardinals. These latter plots were directly below or in the near vicinity of a power line that crossed the vineyard and was a favorite roosting site. As further proof of the perfidy of birds, one vine only 20 feet beyond one of the 100-foot test vines was badly hit showing a damage loss of 65.3 percent as compared to 14.1 per cent on the test vine. This is another illustration of the futility of making random tests where birds are concerned. Again, I feel that the machine while offering some protection does not have the range it should have.

Undoubtedly, sonic alarm systems have merit. However, at present their big fault seems to lie in the fact that they cannot be used in a cookbook fashion. For practical everyday control, this is a necessity along with more accurate estimates of damage being done a crop balanced against the costs of the control measures.

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DISCUSSION: of W. Fitzwater

DELEGATE: Did you make any observations on bird numbers? When we tried to evaluate Biosonics on blueberries, we couldn't go out and count to get the actual berries this way. It was impossible; we tried to base our evaluations on bird numbers.

W. FITZWATER: No, unfortunately, I didn't. In one study all my estimates were relative. In my Thompson study, for example, I noticed linnets were in there first and then they were replaced by starlings. As far as relative proportions or actual bird pressure, I didn't have the time.

DELEGATE: One observation we made particularly on Biosonics in the case of robins was that we noticed a real reduction in juveniles. They may be more susceptible to alarm or distress type sounds, and leave the area, whereas the adults have been habituated to these sounds because of feeding the young.

W. FITZWATER: I think that is probably true.

R. SMITH: What species of birds were you working with? W. FITZWATER:

Linnets, starlings or house finches.

R. COON: Has anyone attempted to your knowledge to try Biosonics on Canada Geese?

W. FITZWATER: No, I haven't done anything. We do have a goose problem, but it's near our rice fields and I haven't worked on the rice in California.

J. SEUBERT: I received some literature from the Av-Alarm people a couple weeks ago and they have an interesting behavioral write-up on this concept of jamming. I wondered if you have had a chance to discuss the behavioral aspects of this concept with any of the behavior people.

W. FITZWATER: No, I haven't. I know it doesn't, of course, work on all species. Most of this stuff I let the grower handle. I figure they will take directions from the Av-Alarm people and use it there. We had one case where we had bank swallows building their nests on the front of a building at Davis. We tried the Av-Alarm for two days and I went through the flutters and the twerps and everything else and nothing happened. The more noise I made, the faster the swallows threw mud. It didn't jam those swallows, and I tried different frequencies and everything else.