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TRAPPING AND MARKING OF SHOREBIRDS AT HUMBOLDT BAY, CALIFORNIA

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Early efforts at trapping shorebirds made use mainly of drift or small walk-in traps, useful only in non-tidal areas (Low, 1935; Rogers, 1946; Holgersen, 1953). Later Austin (1947) and Murphy (1955) suggested using mist nets, and Ogilvie (1963) and Thompson and DeLong (1967) used cannon or rocket nets. Early market hunters used lights to capture shorebirds on the mud at night (Matthiessen, 1967), and Taapken and Mooyman (1969) reported catching several species of shorebirds using this method. Many recent workers have added refinements and additions to these basic techniques (Loftin and Olsen, 1960; Stallcup, 1962; Johns, 1963; Page, 1967; Slade, 1969). In 1968 and 1969 we employed and evaluated four methods for trapping shorebirds on Humboldt Bay, California, as part of a shorebird ecology study (Gerstenberg, 1972). The purpose of this paper is to present the results of this evaluation.

STUDY AREA

At Humboldt Bay thousands of acres of mud flats provide migration and winter habitat for 40 species of shorebirds. At high tide birds concentrate at specific roosts on shoreline salt marshes or adjacent pastures where they become temporarily vulnerable to trapping. The main trapping site included an area of salt marsh composed of pickleweed (*Salicornia pacifica*), salt grass (*Distichlis spicata*) and cord grass (*Spartina foliosa*) and an adjacent mud flat which was the first area of mud flat to be exposed as the tide began to recede in the bay.

METHODS

We attempted to trap birds on high tide roosts using a night light and rocket net. Mist nets and a drift trap were set along travel lanes on the higher contour mud flats to intercept birds as they walked or flew along the shore. A small generator mounted on a pack frame (Drewien et al., 1967) powered a spot lamp which we used to blind shorebirds roosting above the high tide line at night. A long-handled dip net was used to capture the birds.

The rocket net (Nichols Net and Twine Co., East St. Louis, Ill.) was made of black nylon netting with 25 mm meshes and was 12 m wide and 18 m long. The drift trap consisted of a clover-leaf trap (Low, 1935) with leads 0.6 m high which extended for 90 m on each side of the trap just below the high tide line. The trap

had a framework of 10 mm steel reinforcing rod covered with 25 mm mesh wire.

Mist nets (Bleitz Wildlife Foundation, 5334 Hollywood Blvd., Hollywood, California) were 10 to 18 m long and 2 m high with stretched mesh size ranging from 38 to 60 mm. Several nets were modified by reducing the overall length by one meter but leaving the netting the same size.

The nets were set in one or two lines perpendicular to the shoreline and extended from the salt marsh 30-60 m onto the mud flats. One net usually was placed parallel to the shoreline on each end of the main line of nets. Nets were opened before the tide became high, closed at high tide and reopened as the tide began to recede. Care had to be taken to set nets high enough to avoid drowning birds caught in the lower shelf of the nets before the water had receded entirely.

RESULTS AND DISCUSSION

Night Light

The night light was tested on three nights for a total of 27 man-hours. Only three sandpipers were caught (Table 1). Low capture success apparently was caused by our unfamiliarity with the birds' nocturnal habits, backlighting from surrounding cities and highways, a full moon on one night and the diffusion of the spot lamp used. We feel that with more experimentation and refinement, night-lighting of shorebirds has considerable potential as a trapping technique. We would recommend such operations on dark nights in locations without backlighting and the use of a spotlight with a narrow-concentrated beam.

Rocket Net

The rocket net was fired six times at concentrations of roosting shorebirds on the salt marsh at high tide, and 1,275 birds representing 12 species were caught (Table 1). Because of the relatively large mesh size of the rocket net we used, many of the smaller species escaped and it was selective for the larger species (Table 1).

The most important factor of rocket netting in this tidal area was net placement. Baiting did not seem possible under our trapping conditions, so we relied on careful observation and knowledge of the locations of roosting concentrations of birds for net placement. Rocket netting over mud was not desirable because of the necessity to keep captured birds clean and dry. This restricted our operation to known roosts on salt marshes and to times when the high tide flooded the mud but would not be high enough to flood the net or roost. The net was usually placed into position 1-2 days prior to firing at low tide when birds were feeding away from the roost. Human activity in the vicinity of the net was kept at a minimum to avoid disturbing birds. When birds encountered the newly-set net they often moved their roost a few meters away, and it was sometimes possible to "herd" them in front of the net for firing by having a person walk slowly toward the flock from

TABLE 1.

Numbers of shorebirds caught by three methods at Humboldt Bay, California, 1968–1969.

Species captured	Mist nets	Rocket net	Night light	Total
Small Species				
Least Sandpiper (*Calidris minutilla*)	342	3	1	346
Western Sandpiper (*Calidris mauri*)	2,026	142	2	2,170
Semipalmated Plover (*Charadrius semipalmatus*)	39	0	0	39
Dunlin (*Calidris alpina*)	150	3	0	153
Short-billed Dowitcher (*Limnodromus griseus*)	87	597	0	684
Long-billed Dowitcher (*Limnodromus scolopaceus*)	2	65	0	67
Dowitcher species (*Limnodromus* sp.)	14	77	0	91
Other[1]	26	15	0	41
Subtotal small species	2,686	902	3	3,591
Large Species				
Black-bellied Plover (*Pluvialis squatarola*)	0	50	0	50
Willet (*Catoptrophorus semipalmatus*)	0	66	0	66
Marbled Godwit (*Limosa fedoa*)	0	256	0	256
American Avocet (*Recurvirostra americana*)	0	1	0	1
Subtotal large species	0	373	0	373
Total	2,686	1,275	3	3,964
Total no. hour/attempt/day	832	6	27	
Birds/hour or attempt	3.2	213	0.11	

[1]Includes Killdeer (*Charadrius vociferus*), Ruddy Turnstone (*Arenaria interpres*), Black Turnstone (*Arenaria melanocephala*), Common Snipe (*Capella gallinago*), Knot (*Calidris canutus*), Northern Phalarope (*Lobipes lobatus*), and Red Phalarope (*Phalaropus fulicarius*).

either side along the shoreline. As the birds were approached those nearest the intruder flew over the flock and landed on the opposite side. This leap-frog process continued until the birds were in front of the net. It was important that the "herder" move slowly and deliberately and that there were no other sudden disturbances.

When the net was fired, it was vital that sufficient assistants were present to remove birds quickly. We found crates superior to cloth bags for holding birds, because they could stand and preen themselves without crowding, preventing overheating. During

our trapping operations (all methods) 143 birds died (3.5% of those caught), but 62 died on the first firing of the rocket net when the size of the crew was inadequate and birds were held in cloth bags. The rocket net has great potential for trapping shorebirds. It was the only method tested that showed promise for catching the larger species.

Drift Trap

The drift trap was placed along the high tide line for a total of 4 trap-days. Leads were extended along the mud flats to guide birds toward the trap, but no birds were trapped. The trap and leads became clogged with debris and algae by tidal currents.

Mist Nets

One to 15 mist nets were set for 832 net-hours and 2,686 shorebirds of 14 species were trapped (Table 1). Mist nets were highly selective for the smaller species which made up 99% of the total catch. No birds larger than dowitchers were caught in the mist nets (Table 1).

Smaller mesh nets were more effective for smaller species whereas larger mesh nets were more effective for dowitchers and dunlins. Black nets appeared to be less conspicuous on foggy days, whereas gray, blue or brown nets were less conspicuous on cloudy days. Our attempts to use nets at night met with no success, but many birds were caught at daybreak or shortly after sunset.

As the tide receded, birds flew parallel to the shoreline onto the earliest mud flat exposed, and were intercepted and caught by the nets. Best results were obtained in the relatively short period while the receding tide was just exposing the mud flats beneath the nets. As the tide continued to drop, the major feeding and flight activity followed the waterline outward into the bay well beyond the nets and few additional birds were caught until the rising tide again barely flooded the mud under the nets.

Many birds appeared able to see the nets and avoided them. The best results in capturing birds came when a large flock, flying in a long line, approached the nets. The lead bird saw the net and flew over it, but birds in the rear did not respond as fast and often flew into the net. Frequently, the last one-quarter of the flock was caught.

As soon as some birds were caught they began to struggle and utter distress calls (Luther, 1968). This frequently attracted additional birds that "mobbed" the net and became entangled. Whenever a net held 30 to 50 birds, their weight stretched the net so taut that succeeding birds bounced off without being caught.

On several occasions a tape recording of the distress call of a Western Sandpiper was played, in an effort to lure approaching birds to the nets. The tape recorder was usually played from one end of the line of nets, or at a location which placed the nets between the recorder and the flying birds.

Response to the recording varied and no quantitative data were taken, but general impressions are of interest. Western and Least sandpipers responded to the tape and were caught. Dow-

itchers altered their flight path toward the sound several times, but none came close enough to be caught. There appeared to be a seasonal difference in the response of birds to the tape. During migration periods flocks as well as individual birds responded, but in winter periods only single or pairs of birds responded. An example of a successful response occurred on 8 May when only 5 birds had been trapped in 4 net-hours of effort without the tape. The tape was played and more than 50 Western Sandpipers were attracted near the nets and 40 were caught. After these birds had been removed the tape was played several times again with a total of 75 birds being trapped.

On 13 November 1969, even though many birds were moving close to the net, only single birds were attracted to the recording. Two Red Phalaropes were caught as they responded to the tape.

Cardboard silhouette decoys (Loftin and Olsen, 1960) approximating dowitchers in size were set underneath the nets and appeared to attract dowitchers, but no other species.

We feel that the use of decoys and tape-recorded distress calls is promising enough to warrant further trials.

Marking

In order to determine shorebirds' length of stay in Humboldt Bay, birds were marked on the breast with picric acid (Kozlik et al., 1959). Yellow marks were easily seen through a spotting scope, but were suprisingly inconspicuous to the naked eye or through binoculars. Each bird had to be examined individually to be certain marked birds were not missed. The color was retained for the life of the feather, but with age the bright lemon yellow of freshly marked birds mellowed to a less intense golden yellow.

The rectrices of a few birds were marked with a fast-drying airplane dope (Butyrate Dope, The Testor Corps., Rockford, Ill.). This method proved unsuitable because of the time required to apply the dope, the drying time, the tendency of the dope to mat feathers, and the poor visibility of the rectrices of feeding shorebirds.

The most observable and successful marker was the application of colored plastic tape over the standard aluminum band (Frankhouser, 1964; Johnson, 1971). To make the tag more obvious an additional tab was extended beyond the band by taping the two ends together. The tab occasionally interfered with the ability of the smaller species to run if the tab was too long. On larger birds, the band and tab were applied above the tarsal joint, making the tape visible even when the birds were in the water. The tape retained its color at least three years, although yellow tape tended to fade and appeared whitish with age. This marker was seen many times before the yellow breast mark.

SUMMARY

In 1968 and 1969, 3,964 shorebirds of 18 species were trapped using mist nets, a rocket net, and night light. A drift trap proved

unsuccessful. Mist nets yielded 3.2 birds per net-hour (832 net-hours), but only small or medium-sized species were trapped. Six firings of the rocket net yielded 213 birds per shot, mostly medium-sized and larger species. Only 3 birds were caught with the night light in 27 man-hours of effort. The poor success was due to the diffusion of light, back lighting, and our unfamiliarity with the nocturnal habits of the birds. Birds were marked successfully by applying picric acid to breast feathers and by applying colored plastic tape over the aluminum band. Airplane dope painted on tail feathers was unsatisfactory for marking shorebirds.

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