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# Drive-by netting: a technique for capturing grebes and other diving waterfowl

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***Abstract:*** We describe a new method (drive-by netting) for capturing grebes (*Podiceps* spp.) and other birds that dive under water to escape capture. We used a floating gill net to capture 203 eared grebes (*Podiceps nigricollis*) in 20 days in 1999 on the Great Salt Lake (GSL), 652 eared grebes in 41 days on the GSL in 2000, and 409 grebes in 20 days in 2001. Other species captured during the 2000 and 2001 field seasons included 1 western grebe (*Aechmophorus occidentalis*), 9 ruddy ducks (*Oxyura jamaicensis*), and 1 Canada goose (*Branta canadensis*). Two people, a motorboat, and a gill net are required for drive-by netting. Our method was efficient, having a high capture rate per unit effort and a low mortality rate. Drive-by netting can be used to capture both individual grebes and large numbers of grebes on open water.

***Key words*:** capture technique, diving duck, eared grebe, gill net, grebe, *Podiceps nigricollis*

**Wildlife** damage management and biological studies often require the capture of free-ranging animals to reduce population numbers, relocate problem animals, assess population trends, conduct experiments, monitor disease, and determine population characteristics. As part of the Utah Division of Wildlife Resources (UDWR) Great Salt Lake (GSL) Ecosystem Project, we needed to capture large numbers of eared grebes (*Podiceps nigricollis*) throughout the year for various research activities (Caudell 2000). Several aspects of eared grebe behavior make these birds difficult to capture. Grebes seldom fly to avoid danger unless they are recent migrants or are preparing for migration; hence, methods used to capture flying birds (e.g., mist nets) do not work well most of the year. Grebes typically do not come ashore, so walk-in traps and shore-based rocket nets also are ineffective. Grebes commonly avoid capture or danger by staying away from shore and swimming to the bottom of the lake (Jehl and Yochem 1987, Jehl 1988); therefore, our method had to work well on open water.

Cowan and Hatter (1952) described a method for capturing diving waterfowl. We did not try this technique because it requires a bottleneck in the lake, an island near shore, or a similar setup where the birds can be driven into the trap through a restricted area. Such areas are lacking on much of the GSL. Other capture techniques for diving birds include using mist nets or similar nets placed underwater along the shore (Johnson 1972, Breault and Cheng 1990), driving birds into gill nets (Lensink 1957; Ferguson 1980; W. S. Boyd, Canadian Wildlife Service, personal communication), and chasing grebes with a boat and capturing them with a long-handled fish net (Jehl and Yochem 1987). However, none of these methods was successful for capturing large numbers of eared grebes on the open water of the GSL. In this paper, we describe a modification to the gill net technique that was successful for capturing large numbers of diving birds on open water.

## Methods

In 1999, we used a 91- x 3-m gill net made from 4-kg test monofilament netting with 5- x 5-cm mesh. We attached a lightweight lead-line (0.05 kg/m) to the bottom of the net and a 1.3-cm diameter foam-core float-line to the top. A 10- x 15-cm boat fender was attached to each end of the float-line to increase buoyancy and visibility of the net ends. We packed the net in a 115-liter plastic container by placing 1 end of the net in the container and then pulling the net hand over hand into the box. We used a 5-m aluminum boat with a 60-horsepower outboard motor to deploy and retrieve the net. The container with the net was placed beside the motor against the back of the boat so that the net would not catch on anything as it was deployed. The top of the box was higher than the boat sides to prevent the net from snagging on the boat (Figure 1).

After we located a group of grebes, we drove the boat into the group at 32–48 km/hr (Figure 2a). Once the boat was well into the group, we threw a boat fender attached to 1 end of the net over the side of the boat away

**Figure 1.** Deploying the net.

from the motor and monitored the deployment of the net. As we drove through the grebes, they dove to avoid the boat. We drove the boat in a straight line or in a C-shaped pattern (turning into the side of the boat where the net was trailing) until the net was deployed (Figure 2b). We then headed toward the center of the net for retrieval, which caused any surfaced birds to dive once again (Figure. 2c).

We stopped the engine so that the bow of the boat drifted over the center of the net. One person went to the bow and used a boat hook to retrieve the net while the driver raised the motor and propeller completely out of the water to avoid damaging the net. The driver typically pulled in and checked the side of the net behind the boat, while the other person pulled in and checked the side in front of the boat (Figure 3). As we encountered birds entangled in the net, we placed them inside the boat along with the section of net they were in. The remaining portions of the net were kept outside of the boat. This process took less than 120 seconds from the time the net was deployed until the time all the grebes were retrieved. It is important to check the net as quickly as possible to prevent birds from drowning. Once all grebes were pulled out of the water, we freed them from the net. Once a grebe was free, it was placed in a holding container. Then we freed each succeeding grebe until all birds were untangled from the net and placed in holding containers. The net was then repackaged into the container for the next deployment.

We also captured individual birds using the same method as for multiple birds. When trying to capture a single bird, we deployed the net in a U-shaped pattern around the suspected location of the submerged bird. Once we deployed the net, the boat entered from the open portion of the U to encourage the bird to swim into the net, and then we retrieved the net.

In 2000, we captured eared grebes using the same technique but made several modifications to address potential bias in the sampling technique. In addition to the net size used in 1999, we used a net constructed of the same sized nylon filament, but with a slightly larger mesh size (5.7- x 5.7-cm mesh). To determine if nets constructed of different mesh sizes would capture birds of a particular size range, we captured birds from the same flock with the 2 different nets. We randomly determined which net size was used first by a coin toss. We compared the birds' weights using the General Linear Model (GLM) procedure and calculated

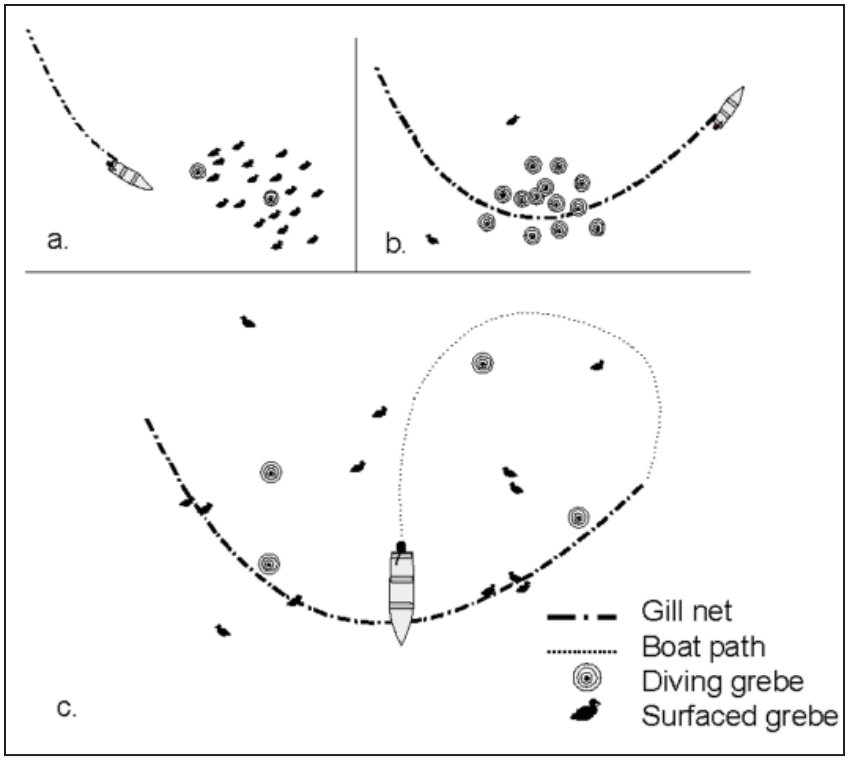


**Figure 2.** Sequence for capturing grebes using drive-by netting.

an estimate of effect size ($Eta^2$) using the birds' weight as our dependent variable and groups of eared grebes and net size as fixed factors.

To reduce capture mortality, we experimented with our retrieval method. In 1999, we retrieved only the portion of the net containing a bird. However, in large groups of grebes, additional grebes would swim into the net and drown while we were untangling captured grebes. To avoid this problem, whenever we captured large groups of birds, we pulled the entire net into the boat. Grebes were then freed from the net and placed into buckets. We drove the boat away from any grebes, slowly redeployed the net into the water, and repackaged the net into the container. This technique was used exclusively during the 2002 field season.

## Results

From September 20, 1999, through November 18, 1999 (20 days of capture attempts), we captured 203 grebes using drive-by netting. Adult and juvenile grebes often congregate in large numbers but in separate groups, allowing large numbers of grebes to be captured in a single deployment of the net. Mean capture sessions were 10 minutes from the time the net was deployed until it was repacked. Mean capture success per unit effort for birds that congregated in groups of 200 to >1000 grebes was 0.7 birds/min. As many as 28 birds were captured in a single deployment. Attempts to capture individuals or grebes in groups of 2 to 20 averaged 0.5 birds/deployment. Initial mortality was high (5 birds or 12%) for the first 6 attempts (41 birds captured) while we worked out the proper methods for retrieving the net. For the remaining 162 birds, there was no capture mortality. Mean mortality for the entire period was 2.5%. Some birds that were badly entangled experienced minor cuts, but no serious injuries were observed and no post-release mortality was detected.

We captured 652 eared grebes from April 24, 2000, through November 30, 2000 (41 days of capture attempts). Eared grebes on the GSL are more dispersed from April to the end of August than during the fall stopover period. During this spring and early summer period, grebes generally congregate in small groups of <50 birds (usually in groups of <10 grebes) or in pairs. Attempts to capture individual or paired birds averaged 0.33 birds/deployment. From April 24, 2000, until August 28, 2000, we captured 145 grebes. Mean capture success per unit effort was approximately 0.1 bird/min. From September 6, 2000, until November 30, 2000, we captured 507 eared grebes. The number of grebes caught per deployment and per minute was similar to that of the previous year.

Capture mortality from April 24, 2000, until October 6, 2000, was 4%. From October 7, 2000, until November 30, 2000, we used the modified capture technique where the entire net was pulled from the water (as opposed to ear-lier trials when just the portion containing a bird was pulled from the water). During this period, mortality was 0.6%. The GLM procedure revealed no difference ($F = 0.026$, $df = 1$, $P = 0.872$, $Eta^2 < 0.001$) in size between birds captured with the 5.0-cm mesh net and the 5.7-cm mesh net.

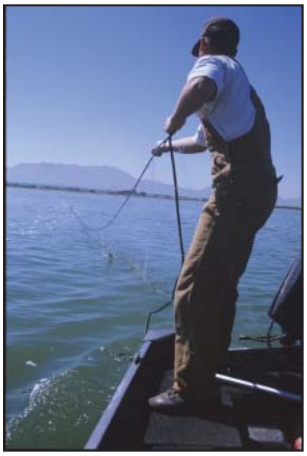

**Figure 3.** Retrieving the net with grebe.

We captured 409 eared grebes from June 16, 2001, through November 19, 2001 (20 days of capture attempts). The number of grebes caught per deployment and per minute was similar to 1999 and 2000. Capture mortality during the entire field season was 1% (5 birds total).

In addition to the eared grebes, we captured several other species. During our 2000 field season, we captured 1 western grebe (*Aechmophorus occidentalis*) among a group of eared grebes. In 2001, we captured 9 ruddy ducks (*Oxyura jamaicensis*) and 1 Canada goose (*Branta canadensis*) using the same techniques used on individual eared grebes.

## Discussion

Our drive-by netting method for capturing diving birds on open water resulted in low mortality and high efficiency. It has promise for working on a wide range of diving birds. Drive-by netting resulted in little mortality because the net could be deployed and retrieved with minimal delays. It is important with diving birds to retrieve the net within the range of time that they are able to hold their breath. Grebes typically are able to spend 90–120 seconds under water during their normal diving activities (Cullen et al. 1999, Caudell and Conover 2006), so the chance of birds drowning using drive-by netting is minimal. On 3 occasions in 1999 and 8 occasions in 2000, birds became entangled in the net between the times the net was initially checked and when it was repacked in the container. These instances account for over 60% of our mortality. Watching the net

for additional birds on or near the surface can reduce bird mortality. However, it cannot be completely avoided when sections of the net are left in the water because birds can become entangled near the bottom of the net where they are undetectable from the surface. Therefore, in instances where there is a high likelihood that new birds will become entangled in the net while birds are being removed, we recommend that the entire net be removed from the water before any birds are removed from the net.

Our bird mortality rate never reached zero in 2000 and 2001, primarily due to capturing birds in high winds (>10 knots). High winds impeded locating and retrieving the net, thereby increasing the chance of birds drowning. Our method worked best in light winds (1–3 knots). With no wind, the net was difficult to straighten and repack. With winds >10 knots, the operation became dangerous to the crew, and retrieval was difficult, often requiring more than 120 seconds. The only birds that died when using our modified technique (i.e., when the entire net was retrieved from the water) were grebes captured in high winds, because retrieval took longer than usual. Therefore, to minimize mortality we recommend that this method be used with winds <10 knots.

Our success with other species was mixed, primarily because the mesh of the net was undersized. We caught >20 ruddy ducks that were able to free themselves from the net. The 9 ruddy ducks we were able to capture were not caught as securely as the grebes because the mesh size was much smaller than the diameter of the duck body. Hence, it is important to select a mesh size that is appropriate for the species being caught.

Drive-by netting has the potential to be especially useful in wildlife damage management situations where other methods for capturing flightless waterfowl have been ineffective and where there is public scrutiny. Diving waterfowl that may avoid boaters during waterfowl roundups may be able to be gathered up using this method. Because mortality is low, this method can also be observed by the public with little distress to on-lookers over concern for the birds.

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