

# Methods of aquatic and terrestrial netting to capture Eurasian beavers

*Frank Rosell and Bjørnar Hovde*

**Abstract** Effective live-trapping of beavers (*Castor* spp.) has been and will continue to be necessary for introductions, re-introductions, translocation, or to obtain animals for breeding and zoological gardens. Here we describe a new method of directly capturing beavers (*C. fiber*) alive. We captured beavers from 3 rivers in Telemark County, Norway, from 31 March to 23 September 1999. Working at night (2000-0845 hours) with a 2-person team in a boat, we located beavers with a spotlight and captured them using 4 different landing nets. We captured 84 beavers during 22 nights and 130 hours of effort. We used 0.3 nights/beaver and worked on average  $5.9 \pm 2.3$  hours/night; mean capture effort was  $1.9 \pm 1.1$  hours/beaver. Number of captures during a night ranged from 1 to 8. We captured 18 beavers on land with the land net or the scoop net, 56 in water with the diving net, and 10 by scooping them directly out of the water with the scoop net. We captured beavers as early as 2120 hours and as late as 0755 hours, with the greatest capture rate recorded between 0200 and 0300 hours. We captured 39 beavers (47%) between 2400 and 0300 hours, when it was completely dark. A major decrease in capture rate was recorded at 0300-0500 hours. Capture rates on cloudy versus clear nights did not differ. We captured 76.2% adults, 9.5% 2-year-olds, and 14.3% one-year-olds. Mean weight of animals captured in the landing nets was  $18.4 \text{ kg} \pm 6.6$  (range 3.5 to 30.5 kg). There was no difference in frequency of males and females captured. We also recaptured 10 selected beavers with a fine-mesh diving net during 14 hours of effort, with a mean recapture effort of  $1.8 \pm 1.0$  hours/beaver. This capture technique is quick, efficient, and resulted in no mortalities or injuries to either beavers or researchers. Our method is best suited for large river systems but also may be used in lakes and large ponds or even on land.

**Key words** beaver, capture, *Castor fiber*, landing net, live-trapping, night-lighting

Effective live-trapping of beavers (*Castor* spp.) has been and will continue to be necessary for introductions, re-introductions, translocation, or to obtain animals for breeding and zoological gardens (e.g., Novak 1987, Rosell and Kvinlaug 1998). The most common methods of live-trapping beavers (reviewed by Rosell and Kvinlaug 1998) use either Hancock or Bailey live-traps. However, Hancock and Bailey traps are cumbersome (weights are 13 kg and 11 kg, respectively) and expensive (approximate US \$225/Hancock trap and US \$427/Bailey

trap), making it difficult and costly to use a large number of traps simultaneously. Snares, which are smaller and less expensive, are very effective, but the mortality rates may be high (5.3%, McKinstry and Anderson 1998). In addition, beavers trapped with Hancock or Bailey traps or snares may remain in the trap for an extended period. Beavers kept for a long time in a trap that is partly submerged may die from hypothermia (Macarthur and Dyck 1990) or a sudden increase in the water level may drown the trapped beavers. Beaver kits may die after 4-5

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hours in a live-trap because their fur is not yet waterproof (Wilsson 1960). While in the trap, beavers also may break their incisors, damage their premolars, or injure their rostrum on the metal bars of the trap (personal observation).

Several researchers have driven beavers from lodges-dens and caught them with landing nets, nets of other types, or cages when they leave the lodge exits (see review by Rosell and Kvinlaug 1998). At a time when public concern over the treatment of animals is increasing, wildlife biologists should explore alternative ways of minimizing stress to the animals they study. Here we describe a method to directly capture beavers alive from a boat.

### Study areas

We conducted our study on the Lunde (59°17'N, 09°06'E), Gvarv (59°25'N, 09°04'E), and Saua (59°25'N, 09°17'E) rivers in the municipalities of Nome and Sauherad in Telemark County, Norway. The rivers meander through mixed woodland and agricultural countryside dominated by marine and fluvial deposits. However, the river Saua also has long distances with high, rocky, often vertical cliffs. The rivers Lunde and Saua have several oxbows, which are not present on the river Gvarv. All the rivers flow slowly and have mostly clear water. Their width varies from 10 m to 100 m. Vegetation along the rivers consists mainly of alder (*Alnus incana*), with lesser amounts of willow (*Salix* spp.), birch (*Betula pubescens*), aspen (*Populus tremula*), rowan (*Sorbus aucuparia*), Norway spruce (*Picea abies*), and Scots pine (*Pinus sylvestris*).

### Methods

#### Materials

The rivers have been occupied by beavers since the 1920s (Olstad 1937). Hunting and trapping pressure are presently light, so population density is high. We surveyed beaver sites for activity during spring prior to capture. We found 8 active colonies on 11 km of stream in Lunde (one colony/1.4 km), 5 active colonies on 6 km in Gvarv (one colony/1.2 km), and 8 active colonies on 15 km in Saua (one colony/1.9 km).

Equipment included a 14-foot aluminum Linder 410 fishing boat with a 4-hp Mariner outboard motor, 2 quartz-halogen handheld spotlights (12V,

55W, Art. ML-328) connected to 2 marine batteries (78 amp), 2 Silva 471 headlamps (with 2 halogen bulbs [10W and 20W]) with 4 batteries, 4 long-handled landing nets, and several cloth holding sacks.

During the first capture period, from 31 March to 16 April 1999, we captured beavers only on land with a land net. This net was made with a cloth sack because we were able to recapture beavers that had been eartagged earlier (avoiding snagging the tags in a mesh net) (Figure 1a). During the second capture period, from 22 April to 23 August, we used a diving net (Figure 1b) developed for catching beavers in shallow water (<1.20 m deep). In July we used a scoop net developed to scoop beaver kits out of the water (Figure 1c).

#### Description of capture technique

In principle we used the same procedure to capture beavers in water or on land. We searched colonies at 10–30 m from the riverbank. The start and end time varied from 2000 to 2400 and 0045 to 0845 hours, respectively. Usually we searched only one side of the river at a time. One person (the trapper) sat in the front of the boat with the landing nets and one (the driver) maneuvered the boat. At dark, we used spotlights to search for beavers. When one was sighted, we approached at moderate to top speed with headlamps and spotlights trained on the animal. We were careful to eliminate shadows of the trapper across the light beam. Just before the catch attempt we turned the spotlights off to free both hands, but we left the headlamps on. In many cases the beaver did not appear to be disturbed by the light or motor noise, often continuing to feed at the water's edge or on land up to the moment of capture.

When the boat was close to the bank, the trapper jumped out, ran toward the beaver, and made a capture attempt with the land or scoop net (Figure 1a). Most captures occurred while beavers were slowly walking farther onto land in the glare of the light. Some beavers appeared to be paralyzed by the light beam and stood still, whereas others attempted to escape back into the water.

Beavers that were on the banks were often disturbed by us and dove into the water. These were most often caught a few meters away from the bank in shallow water. Beavers that managed to escape to deeper water tended to swim just below the surface and we could easily follow their underwater movements from the boat with the spotlights. When the driver got the boat in a position

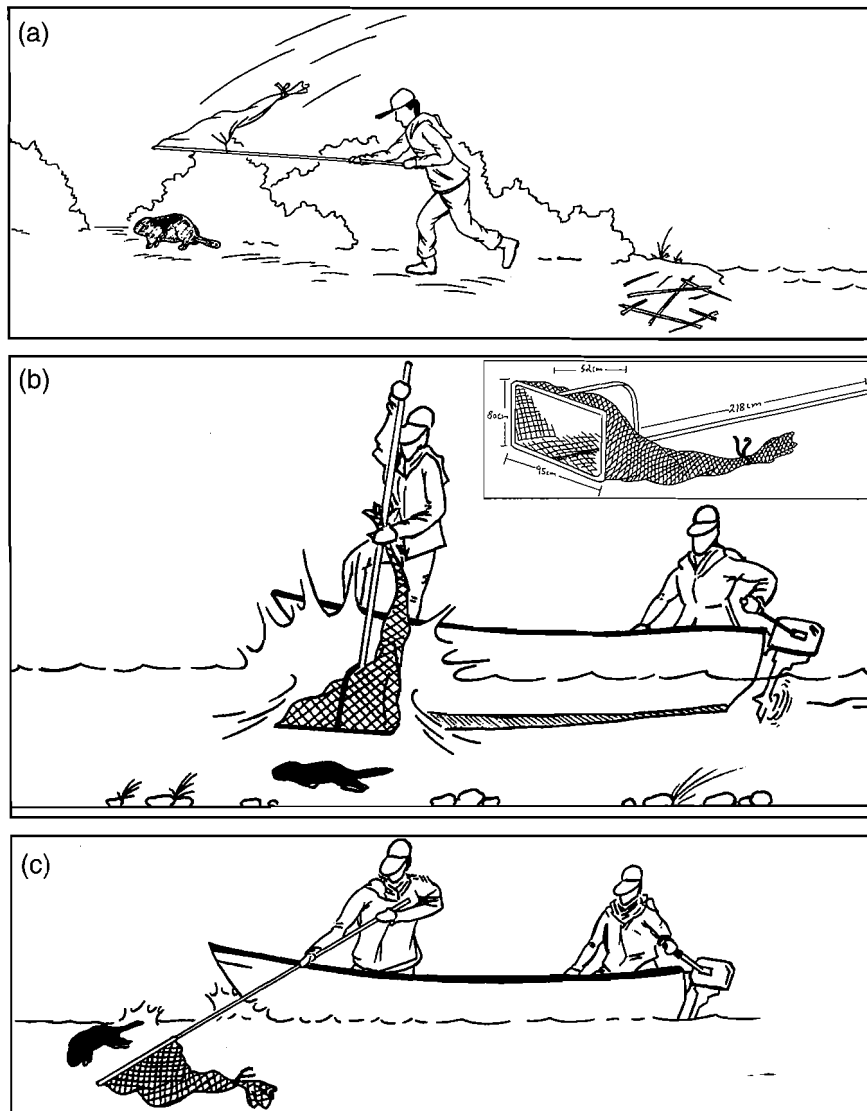


Figure 1. A typical trapping situation involving adult beavers (a) on land, using a net made of a cloth sack (60 cm diameter and 80 cm long) attached to a 187-cm-long iron tube and weighing 3.9 kg, and (b) in water, using a nylon-mesh (1.0-cm) diving net weighing 7.7 kg. A rope attached to the pole allowed the net opening to be closed when the beaver reached the water's surface, thus preventing its escape (not shown). (c) Demonstration of how to catch kits in water with a nylon-mesh (1.0-cm) scoop net with an opening of 60 × 60 cm. This net was 130 cm long, weighed 4.1 kg, and was attached to a 220-cm-long iron tube. Drawings by Øyvind Steifetten.

close to the beaver, the trapper drove the diving net down so that the frame surrounded the beaver and was buried in the mud (Figure 1b). In most cases the trapper had to jump out of the boat just before netting the beaver. When the beaver was entangled in the net, the trapper held the diving net tight to the bottom by standing on the frame to keep the beaver from escaping, while the net was closed with the drawstring. The driver then tightened a

rope close to the opening of the net as an extra security. Ropes in both ends of the net made it easy to immediately carry the beaver to land.

Beaver kits were scooped easily out of water with the scoop net (Figure 1c). Kits are not very good divers and usually emerged on the surface very soon after a dive.

We recorded time of capture to the nearest 5 minutes. Weather conditions also were recorded. We did not try to recapture beavers during the first 2 capture periods (31 March–23 August).

During 3 nights in September we attempted to recapture 10 eartagged animals to implant radio-transmitters. We developed another diving net but with a finer nylon mesh (0.5 cm). It had a net opening of 61 × 89 cm, was 181 cm long, was attached to a 201-cm-long iron tube, and weighed 7.4 kg. During the first night the weather was clear with no wind and water visibility was good; during the second night it was raining, foggy, and windy; and during the third night it was mostly clear and no wind or fog.

#### *Handling, sex, and age determination*

The driver opened the bottom of the net by loosening 2 ropes, which allowed the beaver to move from the net into a cloth sack. We did not use a sedative. Beavers were sexed by color of the anal gland secretion (Rosell and Sun 1999), weighed, and eartagged while they were restrained in the sack. To determine effect of age (body mass) on net

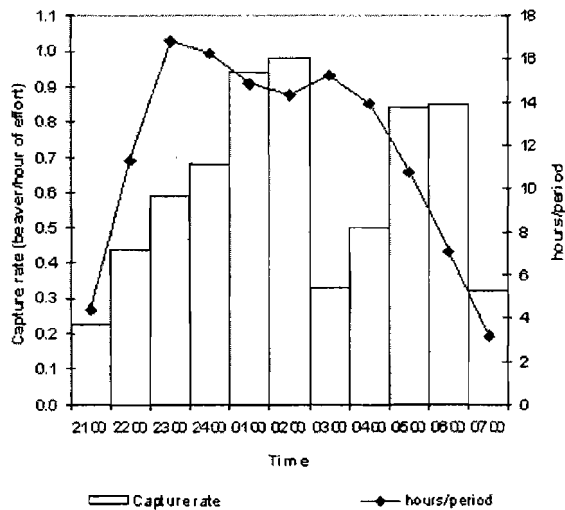


Figure 2. Capture rates (beaver/hour of effort) during the night and hours of effort during each period.

preference, we partitioned the captured beavers into 3 age (mass) classes (Hartman 1992): 1-year-olds (<12 months, 0–10 kg), 2-year-olds (12–24 months, 10–15 kg), and  $\geq$ adults ( $\geq$ 24 months,  $\geq$ 15 kg). We recorded time of handling to the nearest minute.

### Data analyses

For all analyses, we included all new beavers ( $n=4$ ) that we captured during the recapture nights and excluded those beavers ( $n=3$ ) recaptured during the second capture period except when we calculated mean capture rate. When comparing captures of beavers on cloudy versus clear nights, we excluded 22 April. We computed capture effort by including the time from starting to ending the search with the boat and the time for packing the equipment and launching the boat between captures, but excluded handling times for beavers. We performed all statistical analyses using SPSS (version 8.0) software. We used a Mann-Whitney U-test (Siegel and Castellan 1988) for independent samples to compare median capture effort (number of hours/beaver captured) on cloudy nights versus clear nights. All tests were 2-tailed with a  $\alpha=0.05$ .

## Results

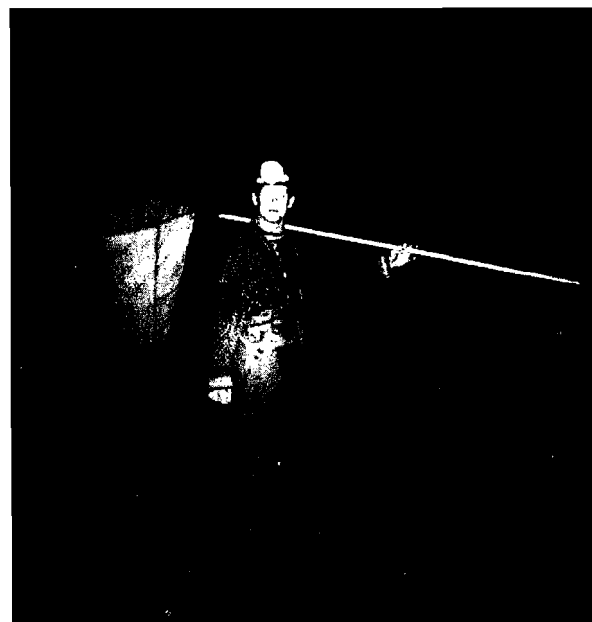
### Capture of beavers without eartags

We captured 84 beavers, which included 3 recaptures of beavers that had lost their eartags, during 22 nights (total effort was 129.8 hours). We used

0.3 capture nights/beaver and worked on average  $5.9 \pm 2.3$  SD hours/night ( $n=22$ , range=0.17–9.00). During the first capture period when we captured beavers only on land, mean capture effort was  $2.3 \pm 1.2$  SD hours of effort/beaver ( $n=4$ , range=0.9–3.6). Overall, mean capture effort was  $1.9 \pm 1.1$  SD hours/beaver ( $n=22$ , range=0.2–4.3). Number of captures during a night ranged from 1 to 8. We captured 18 beavers on land with the land net or the scoop net, 56 in water with the diving net, and 10 by scooping them out of the water with the scoop net.

We captured beavers as early as 2120 hours and as late as 0755 hours, but the greatest capture success (least effort) was recorded between 0200 and 0300 hours (1.0 hour of effort/beaver). We captured nearly half of the beavers (47%) between 2400 and 0300 hours, when it was completely dark. A major decrease in capture effort (hour of effort/beaver) was recorded from 0300 to 0500 hours (Figure 2). A few beavers (<15) also were captured when it was completely light. Capture rates on cloudy nights (mean number of hours/beaver captured was:  $\bar{x} \pm \text{SD} = 2.4 \pm 1.5$ ,  $n=7$ ) and clear nights (mean number of hours/beaver captured was:  $\bar{x} \pm \text{SD} = 1.8 \pm 0.9$ ,  $n=13$ ) did not differ (Mann-Whitney U-test,  $Z=-0.48$ ,  $P=0.643$ ).

We captured 76.2% adults (30 males, 34 females), 9.5% 2-year-olds (2 males, 6 females), and 14.3% 1-year-olds (10 males, 2 females). Of these 12



Net used to trap beavers on land. Photo by Frank Rosell.



A trapper closes the diving net with a drawstring to enclose beaver. Photo by Frank Rosell.

1-year-olds, 7 were born during summer (called kits [ $<7$  kg] hereafter). Mean weight of animals captured in the landing nets was  $18.4 \text{ kg} \pm 6.6 \text{ SD}$  ( $n=84$ , range = 3.5–30.5 kg). Overall, there was no difference in frequency of males ( $n=42$ ) and females ( $n=42$ ) captured. We captured the adult pair in 18 of 21 colonies.

Some beavers observed on land managed to escape into the water, whereas others disappeared into the vegetation farther onto land. It was easier to observe and net beavers when there were no leaves on the trees and when snow was on the ground. Beavers in water escaped only when the water was very turbid or when they reached holes in the bank or lodges. Some beavers were captured but managed to escape under the diving net because the river bottom was uneven. However, we captured them most often on the next attempt, usually within a few minutes. Rain, fog, mist, or muddy-dirty water hindered capture, making it more difficult to find and follow beavers swimming underwater. Although we did not record failure rate of all net types, capture attempts failed on land more often than in water. However, we never failed to scoop a beaver out of water with the scoop net. Also, we did not record when we failed to capture beavers, but we definitely failed more often during evenings or when it was light than during dark nights.

No beavers died or were injured during capture, and we did not observe any obvious symptoms of severe stress. All animals swam off in a normal fashion after release. Of the 78 different beavers captured in our study area, 67 (85.9%) were observed on later capture trips. The handlers were not bitten during the capture.

### Capture of eartagged beavers

Ten eartagged beavers were recaptured during 3 nights (14 hours of effort), with a mean recapture effort of  $1.8 \pm 1.0 \text{ SD}$  hours/beaver ( $n=3$ , range = 0.7–2.7). All animals were recaptured on the first attempt and only a few minutes after they were observed for the first time. Additionally we captured a new 7.0-kg female, a 24.5-kg female, a 14.5-kg male (living outside our study area), and a 24.5-kg female. Only 1 of the 10 individuals had an eartag removed by the net.

## Discussion

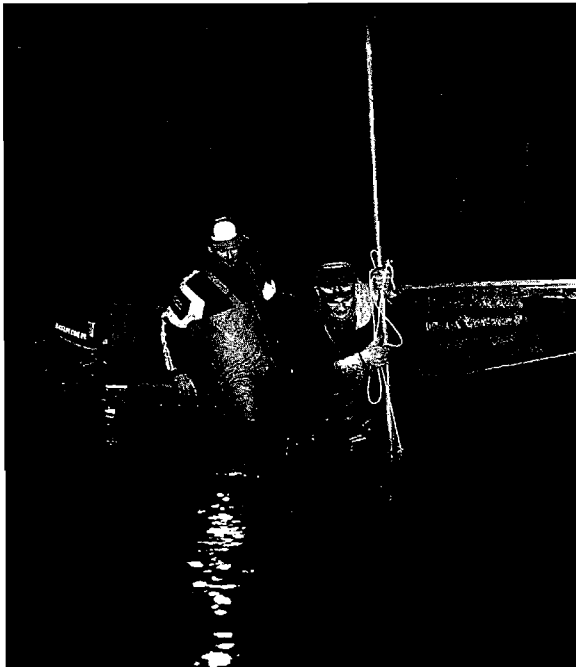
We describe a technique to live-capture Eurasian beavers using 4 different types of landing nets, a boat, and night-lighting. Our capture technique was very efficient (1.9 hours of effort/beaver captured), and we feel our success could have been improved if we had used an engine with greater horsepower. We also believe that a lighter airboat would improve capture success, especially where shallow water prevailed. Our capture success also may have been increased if we had baited strategic locations. We suggest that biologists concentrate capture during the darkest time of the night and when there are no leaves on the trees, no wind or fog or rain, and good snow cover.

We also found that it is easy to recapture beavers using our method. Beavers that are trap-shy due to previous captures can be captured easily with our method.

Noise from the engine helped us by masking the noise of the approaching trapper (movements with the nets in the boat and talking to the driver). It is very difficult to scoop adult beavers out of water



Trapped beaver about to be removed from diving net and placed in cloth sack. Photo by Frank Rosell.



Authors Frank Rosell (left) and Bjørnar Hovde trapping beaver with diving net. Photo by Kåre Vidar Pedersen.

because of their weight and fast movements. If the net basket is too short, beavers also manage to jump out of the net. However, the scoop method worked very well to capture beaver kits and with beavers up to 14.5 kg.

We captured most beavers in the middle of the night when it was completely dark. However, we found a major decrease in capture rate from 0300 to 0500 hours, probably because beavers were less active then.

The even sex ratio of captured animals indicated no sex bias in the technique (if we assume an even sex ratio in the population). We also captured all size classes of beavers in the landing nets; however, the number of 1- and 2-year-olds seemed to be less than expected. We have no idea why we captured so few 2-year-olds. However, Hodgdon and Lancia (1983) stated that kits (born during summer) primarily use habitat that is close to the lodge and generally do not travel far from the lodge or den during their first year. Therefore, our difficulty in capturing 1-year-olds was probably due to the short time they spent outside the lodges. In fact, we captured 6 of 7 kits observed. Another reason may be that we stopped capturing (22 September) before most kits had started their regular activity outside the lodge (Rosell, unpublished data).

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