A leg-hold noose capture method for Brent Geese *Branta bernicla* at staging or wintering sites

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Abstract

Effective and efficient capture methods are needed for marking and monitoring individuals in studies of demography, migration and habitat use. We describe a novel use of leg-hold nooses aligned on lines and mats to capture non-breeding Brent Geese *Branta bernicla* in water at a staging and wintering site in Japan. A total of 24 Brent Geese were caught in autumn 2017 and 2018. The traps, which were easy to set up and transport, were effective at catching small numbers of Brent Goose at intertidal roosting and gritting sites. Leg-hold noose lines and mats may be a suitable alternative to other standard catching techniques, such as cannon-netting and flat net traps, in locations where it is not practicable to use these other methods.

Key words: *Branta bernicla*, intertidal habitat, leg-hold noose captures, non-breeding season, Japan.

The Brent Goose *Branta bernicla* breeds widely across the Arctic with 5,000–8,700 birds wintering in East Asia (Wetlands International 2012). While their wintering ecology has been studied in some parts of East Asia (Lane & Miyabayashi 1997; Syroechkovski 2006; Shimada *et al.* 2013, 2016; Fujii 2017; Ohtaishi *et al.* 2018),

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their winter distribution in China and Korea is still poorly known. There is also only a rudimentary understanding of their migration patterns, and use of staging, stopover, and breeding areas along the East Asian-Australasian Flyway (Shimada *et al.* 2017). New studies therefore are required to determine the migration strategies and distribution of the East Asian staging and wintering population of Brent Geese. Efforts to capture and mark Brent Geese in East Asia during the non-breeding season have largely been unsuccessful because these birds inhabit coastal bays and rarely come ashore. Since 1961, only 10 Brent Geese have been captured in Japan, despite many attempts (Yamashina Institute for Ornithology, unpubl. data).

Cannon-netting and flat net traps have been the principal methods of capture for Brent Geese in winter and spring (Clausen *et al.* 2001; Ward 2004; Tinkler *et al.* 2009; Shimada *et al.* 2016); however, use of these techniques has largely been confined to populations that graze on inland habitats (Ebbinge & Spaans 1995; Inger *et al.* 2006). Capture of Brent Geese on intertidal habitats is rare. Other commonly used methods for catching waterfowl in winter, such as night-lighting, mist nets or drop nets (Bishop & Barratt 1969; Snow *et al.* 1990; Whitworth 1997; Schemnitz *et al.* 2009), are not suitable for catching Brent Geese in Japan because here the geese primarily use offshore locations.

In this study, we captured Brent Geese by leg-hold nooses in autumn 2017 and 2018 at Notsuke Bay, Japan, a primary spring and autumn staging area and, more recently, a wintering area for the species. While leg-hold nooses, including Bal-chatri traps and noose mats, have traditionally been used to capture birds such as geese (Takekawa *et al.* 2009; Simeonov *et al.* 2014), shorebirds (Mehl *et al.* 2003; McGowan & Simons 2005; Hall & Cavitt 2012) and raptors (Schemnitz *et al.* 2009), most were used on inland habitats, occasionally in water with floating-fish snares (Cain & Hodges 1989). This is the first study to use leg-hold nooses to capture non-breeding birds wading in water at intertidal habitats. Here we describe our methods used for catching Brent Geese standing in water at gritting and roost sites, along with the environmental conditions at the time. The methods described in this study will be useful to researchers attempting to catch birds wading in intertidal habitats.

Methods

The study was conducted on 21, 22 and 24 November 2017, and from 28 October–6 November 2018 at Notsuke Bay in the eastern part of Hokkaido, Japan (43.58°N, 145.23°E; Fig. 1). Notsuke Bay is open to the south and protected to the north by the Notsuke-hanto Peninsula, a 26 km-long sand spit. This bay covers an area of approximately 5,700 ha and is shallow with a maximum depth of 4 m at the mouth and a depth of < 1 m across the remaining portion. The bay supports large beds of Common Eelgrass *Zostera marina*, a key food of Brent Geese in Japan (Ministry of the Environment Japan 2015). During autumn migration, over 7,000 Brent Geese stage here from October to December (Fujii 2017).

The Brent Geese fed primarily on eelgrass when it was exposed at low tide in

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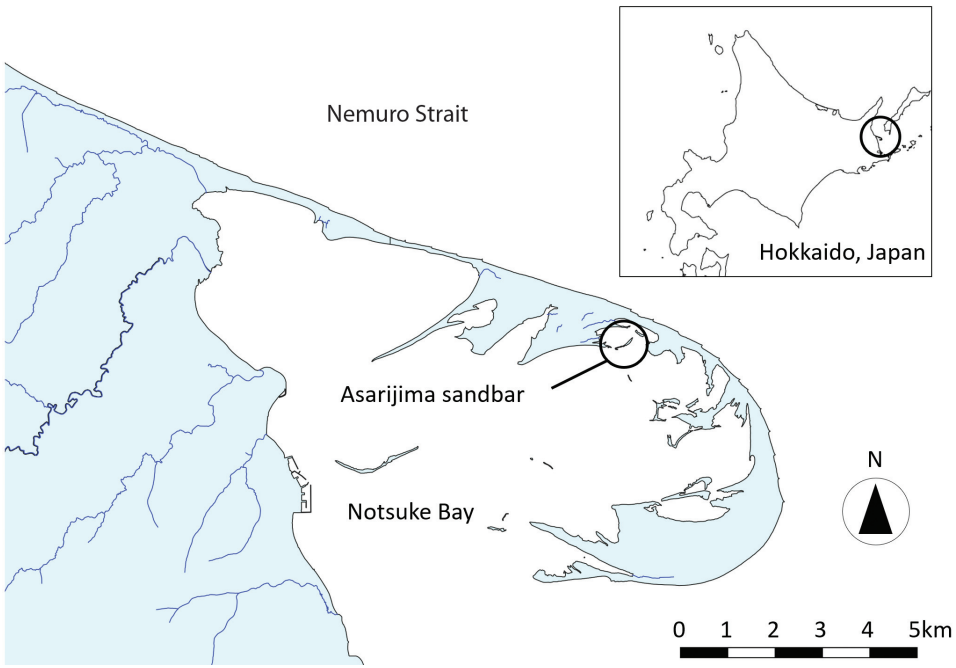

Figure 1. Location used to capture Brent Geese on the Asarijima sandbar within Notsuke Bay, Japan.

the bay. In early morning, they often came ashore onto sand spits or used offshore sandbars to rest, preen and obtain the grit needed to aid digestion of eelgrass leaves and shoots (Spragens *et al.* 2013). Brent Geese generally arrived at the sandbars by flying from nearby locations and landing in water then swimming to the bar to stand in shallow water (Fig. 2). A few birds walked completely out of the water to stand on the edge of the sandbar. We selected one of the sandbars, named "Asarijima", as our catch site for Brent Geese. The Asarijima sandbar is located *c.* 400 m from shore and was accessed by canoe or inflatable kayak.

We used three types of leg-hold noose configurations: short (1.5 m long) and long (10 m long) noose lines, and also noose mats (30 cm × 30 cm). Leg-hold nooses (*c.* 8 cm in diameter) were made from fluorocarbon fishing line (12 lb test designation). Two knots, 4 cm apart, were tied for each leg-hold noose (Fig. 3). The first knot formed the noose for capture of a bird, whilst the second served as a stopper to keep the noose from shrinking too tight and cutting into a snared bird's leg. Each line was doubled between the two knots, which would also reduce the risk of snares cutting into flesh on the legs. We prepared ten short leg-hold noose lines with approximately seven nooses attached to each line, and two long leg-hold noose lines with about 30 nooses attached to each line. We also attached 10 nooses to each of three mats made of polyvinyl chloride. The noose lines

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Figure 2. Brent Geese on the Asarijima sandbar, Notsuke Bay, Japan. Photograph by Yusuke Sawa.

and mats were affixed to the sandbar with 30–45 cm-long metal stakes. To help keep the nooses upright in the waves, we pushed wet sand and small gravel over the bases of the nooses. The noose traps were deployed initially at daybreak, before birds arrived on the bar, and were readjusted after capture or moved to a new location if the water depth changed. We also placed three Brent Goose decoys (Tanglefree Waterfowl, Inc) in the water near the trap to attract birds to the capture site.

Each time a bird was snared, we paddled to the sandbar to retrieve the bird and reset the nooses. It took ≤ 10 min to reach the sandbar and about 5 min to retrieve captured birds and reset the nooses, except on days with large tidal fluctuations when this time typically doubled. All captured geese were brought back to shore for ringing, where they were inspected for any injuries to their leg and wings caused by the trapping. As none were found to be injured, we then fitted each bird with a yellow-colored plastic band with an alpha-numeric code on the left leg and a metal ring on the right leg. We retrieved the noose lines and mats at the end of the daily catch sessions, which typically lasted about 3 h (Table 1).

Results

Brent Geese usually arrived at the Asarijima sandbar in early morning regardless of the tide cycle, when the number of geese

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Table 1. Weather and tidal conditions during Brent Goose catches.

Date	Time	Water Level (cm)	Tide Difference (cm)	Wind Speed (m/s)	Wind Direction[a]	Number of birds captured	Notes
21 Nov 2017	6:45	119	–	1.9	W		Traps set in water
	7:05	117	–2	2.2	WNW	1	Traps retrieved
22 Nov 2017	7:00	119	–	2.6	W		Traps set in water
	7:40	115	–4	1.1	W	3	Traps retrieved
24 Nov 2017	6:55	113		2.2	WSW		Traps set in water
	7:42	114	1	3.0	SW		Traps retrieved
28 Oct 2018	7:24	116	–	1.5	WSW		Traps set in water
	7:49	111	–5	1.4	WSW	1	
	9:05	95	–21	1.8	ESE		Traps retrieved
29 Oct 2018	6:20	117	–1	0.2	–		Traps set in water
	7:18	116		2.6	SSE		Traps retrieved
30 Oct 2018	6:04	102	–	1.5	WSW		Traps set on sandbar
	6:40	107	5	1.3	WSW	1	
	8:03	109	7	2.1	S	1	
	8:47	106	4	2.6	SSW	1	Traps retrieved
31 Oct 2018	6:10	86	–	3.3	SW		Traps set on sandbar
	6:45	93	7	3.5	WSW	2	
	7:10	97	11	2.4	SW	2	
	8:00	102	16	3.9	WSW	1	

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	8:30	103	17	4.5	SW	1	
	8:55	102	16	4.7	SW	1	
	10:16	99	13	4.1	WSW		Traps retrieved
1 Nov 2018	6:00	65	–	2.0	NW		Traps set on sandbar
	7:36	88	23	6.3	NW		Traps retrieved
2 Nov 2018	5:55	51	–	2.7	NW		Traps set up on sandbar
	7:50	76	25	4.2	WNW		Traps reset in water
	9:04	90	39	3.6	NW	1	The traps were retrieved.
3 Nov 2018	5:52	47	–	2.2	SW		Traps set on sandbar
	6:35	50	3	2.7	SW	1	
	7:10	55	8	3.7	SW		
	9:00	79	32	3.7	SW	2	Traps retrieved
4 Nov 2018	6:11	49	–	2.3	WSW		Traps set in water
	6:50	49	0	1.8	WSW		Traps reset on sandbar
	9:30	76	27	1.0	ENE		
	10.15	88	39	1.8	ENE		Traps retrieved
5 Nov 2018	6:18	58		2.8	NE		Traps set in water
	7:30	50	–8	1.6	ENE		Traps reset on sandbar
	9:30	67	9	1.9	E		Traps retrieved
6 Nov 2018	6:15	75	–	2.3	SW		Traps set in water
	6:35	69	–6	2.2	SW	3	
	7:10	61	–14	2.5	SW	1	
	8:20	53	–22	3.5	WSW	1	Traps retrieved

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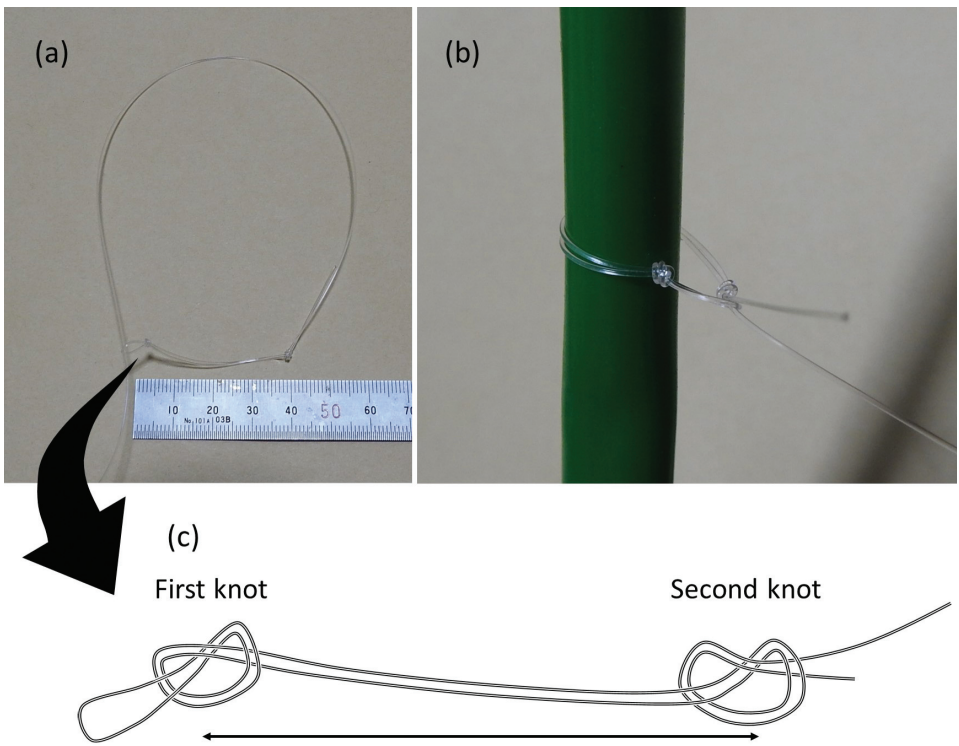

Figure 3. Schematic photos and illustration of a leg-hold noose: (a) each leg-hold noose is about eight cm in diameter with two knots; (b) the first knot allows the noose to tighten around the leg of a snared bird and a second knot, which is 4 cm from the first knot, keeps the noose from tightening too tight; and (c) illustration of the knots.

around the sandbar ranged from 100 to 500 individuals. Nooses were placed in the water at a depth of 10–20 cm during ebb tides, and at the water's edge or 5 cm deep during a rising tide (Fig. 4 and 5). The initial set-up time was about 30 min for two people.

In all cases, Brent Geese were caught when the nooses were located in water. A total of four Brent Geese were captured over a 3-day period in 2017 with three birds caught almost simultaneously on 22 November (Table 1). In 2018, a total of 20 birds were caught over a 9-day period, most on 31 October and 6 November when seven and five geese, respectively, were caught during the 3 h capture sessions. In 2018, two more Brent Geese were snared but escaped from the nooses before we reached them. On these occasions, we suspect the nooses did not tighten correctly and that the birds were able to work their leg free from the noose.

Upon capture, birds called and flapped their wings, causing the rest of the flock to fly, but the geese generally returned to the sandbar within 15 min of our retrieval

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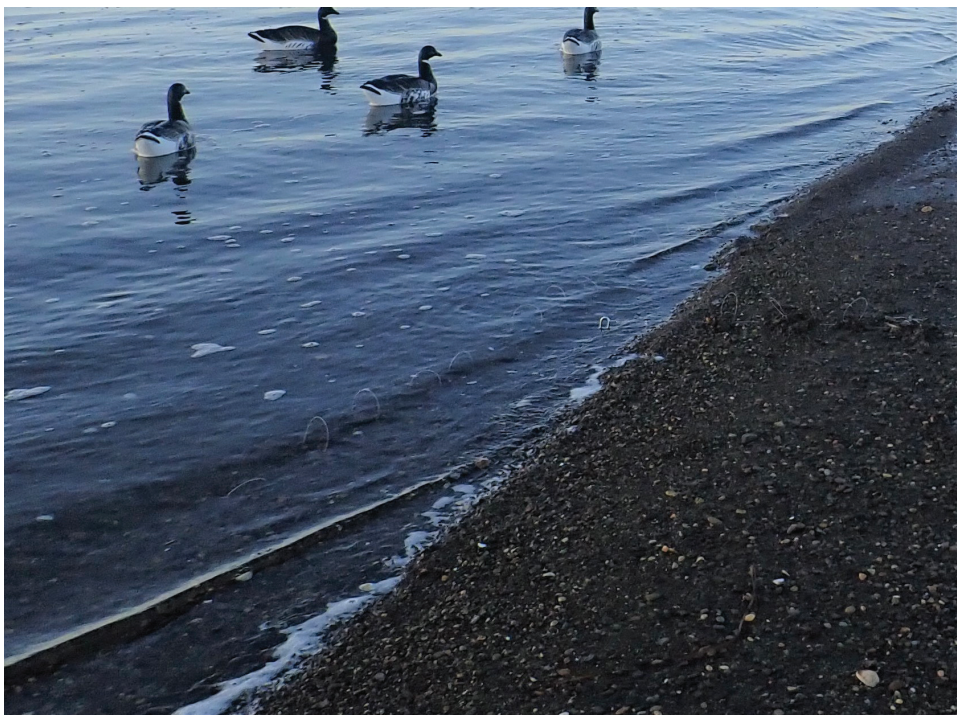

Figure 4. Leg-hold noose lines set in shallow water. Photograph by Yusuke Sawa.

of the birds, during the first hour of the capture session. Thereafter, the time to return to the sandbar typically increased and occasionally geese did not return for > 1 h, as on 31 October and 3 November 2018 (Table 1). In 2017 two Black-tailed Gulls *Larus crassirostris* were caught when the leg-hold nooses were placed too high in the intertidal area and became exposed when the tide dropped on the sandbar. There was no bycatch in 2018, probably because we moved nooses to deeper water soon after they became exposed.

In adverse weather, we had to abandon the capture session early, such as during strong wind conditions on 1 November 2018 (Table 1). Winds from a south to southeast direction on 29 October 2018 also caused waves, because Notsuke Bay is open to the south. Tide conditions also affected the catching success. For instance, during a low morning tide it was hard to predict the exact place where geese would come ashore, because a large area of the sandbar was exposed (*e.g.* on 4 and 5 November 2018; Table 1). Large tidal changes during capture sessions required more time to reset traps, to keep them in goose leg-length water depth (1 and 4 November 2018; Table 1). The tidal conditions when the capture sessions were successful were those with relatively small changes of tide level, such as on 22 November 2017, 30 and 31 October and 3 November 2018 (Table 1).

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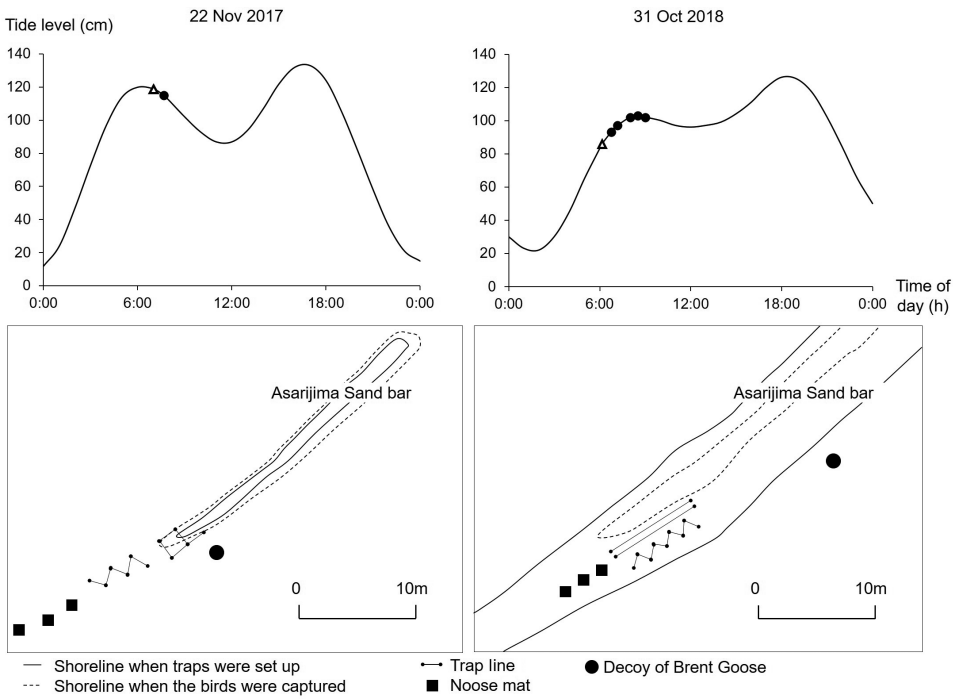

Figure 5. Graph of the tide at Odaito port near the entrance to Notsuke Bay and the location of leg-hold nooses and decoys. The left figure shows the leg-hold noose set up during ebb tide (22 November 2017) and the right figure shows the set-up during rising tide (31 October 2018). △ = time when the traps were deployed. ● = time when Brent Geese were captured.

We detected no injuries caused by the nooses during handling of snared birds. In addition, eight out of 24 marked birds were re-sighted 3–104 days following banding (Y. Sawa, unpubl. data) and all appeared to be healthy with no obvious signs of injury to their legs or wings.

Discussion

Geese are usually vigilant towards human activities during migration and winter, and therefore are likely to be wary of leg-hold noose lines and mats laid on land and visible to the birds. When the traps were set up in water, however, the Brent Geese appeared to be unaware of them, probably because of their reduced visibility. The leg-hold nooses were most successful for catching geese in early morning when the birds used the sandbar, and when the nooses were placed in goose leg-length water depth at the distal end of the sandbar where most geese came ashore. Weather had an important influence on catching success because the leg-hold nooses were easily pushed over by strong winds and waves. It also took more time to deploy and reestablish the noose lines and mats in water when weather conditions were bad. The best tides for captures were those where the water depth was similar over the

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capture session, such as on 30 and 31 October 2018 (Table 1). On days when the tidal range was large (*e.g.* 2 November 2018), the time that noose lines and mats were effective for catching geese was short. It was on these days that we also caught gulls. The tide drops quickly on days with greater tidal ranges, increasing the probability of the nooses being exposed above water, so it is important to be careful about water depth if catching under these conditions, to avoid extended exposure of nooses and capture of non-target birds. The most suitable days for intertidal capture of Brent Geese with leg-hold nooses are those with small variation in water depth between high and low tides and with calm winds. Long noose lines were the most efficient type of leg-hold noose configuration during wide tidal fluctuations, because they covered a wider capture area.

The leg-hold nooses proved to be a good method for capturing small numbers of Brent Geese at intertidal locations that are not suitable for other standard catching techniques. Use of cannon nets would be extremely difficult, if not impossible, at our capture sandbar because the sandbar is mostly underwater prior to the arrival of the geese and the long distance from shore for running wiring. In contrast, leg-hold nooses can be put in place when the sandbar is still underwater and preparations can be completed before Brent Geese arrive at the sandbar. Moreover, the leg-hold noose lines and mats are easy to make, transport and deploy, and require only a few people to manage. The leg loops did not appear to cause leg or foot injuries, even when attached to birds for up to 15 min, and were easy to remove. The leg-hold nooses may also be suitable for capture of Brent Geese at other locations, such as on sandy beaches at the mouth of small rivers where these geese congregate to drink freshwater (Shimada *et al.* 2013). The fishing line with 12 lb test breaking strength would be strong enough for a 1,500 g waterbird, the average body mass of our Brent Geese. We believe that this capture method can be used in other locations and situations and may prove to be an efficient way of catching Brent Geese and other waterbirds in intertidal habitats during the nonbreeding season.

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Photograph: Brent Geese (one with a colour leg-ring and satellite transmitter) at Notsuke Bay, Japan, by Chieko Tamura.

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