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# The provenance of diagnostic specimens of the ‘New Guinea Singing Dog’

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## ABSTRACT

The New Guinea Singing Dog (NGSD) has been diagnosed as a distinct taxon on the basis of (1) two live animals, thought to be wild dogs, either free-living or captive, at the times when they were obtained by Europeans, (2) cranial material from 26 dogs, captive-bred descendants of the original pair, and (3) a single skull reportedly from a free-living wild dog. The NGSD is currently regarded as a behaviourally, morphologically and genetically distinct wild dog found at scattered high-altitude locations on mainland New Guinea, isolated from places where people live and, hence, largely isolated from village dogs associated with those people. We examined historical records to show that few, if any, of the founding members from the captive population of NGSDs, or dogs that served to diagnose *Canis hallstromi* Troughton, 1957, were, in fact, wild dogs or recent descendants of wild dogs. The continuing insistence that high altitude, wild-living NGSDs are a discrete population of dogs is incorrect. Rather, we recommend additional studies of village-living dogs across the span of altitudes and contend that these would yield much information about what was once a pan-New Guinean population of an unusual, and archaic, form of domestic dog.

□ *New Guinea Singing Dog, Hallstrom’s dog, New Ireland dog, dingo, village dogs, wild dogs.*

In 1957, the Australian Museum mammologist Ellis Troughton described two live dogs from ‘Papua’ (Fig. 1) as holotype and allotype of a new species that he named *Canis hallstromi* ‘in honour of Sir Edward Hallstrom, President of the Taronga Park Trust’.

The dogs were held by Taronga Zoological Park (hereafter Taronga). According to Troughton they were a ‘pair of the mountain “dingo”’ that had been obtained in 1956 by Assistant District Officer J. P. Sinclair and Medical Assistant Albert Speer ‘in the remote Lavani Valley [of the] Southern Highlands District of Papua’ (1957: 93). Troughton considered that they

were the same as ‘dingo-like’ dogs reported decades earlier from ‘7,000 ft. on Mount Scratchley’, Owen Stanley Range. Skins and skulls of Mount Scratchley dogs, held by the Queensland Museum had been described by de Vis (1911), Longman (1928) and Wood-Jones (1929). Troughton agreed with Wood-Jones’ opinion that the ‘Papuan dog’ was ‘a very definite race ... differing widely in its characters from the dogs of certain other Pacific islands’ (1957: 93). In a later paper Troughton (1971: 93) reinforced his opinion that the dog he had described was a primitive, wild-living

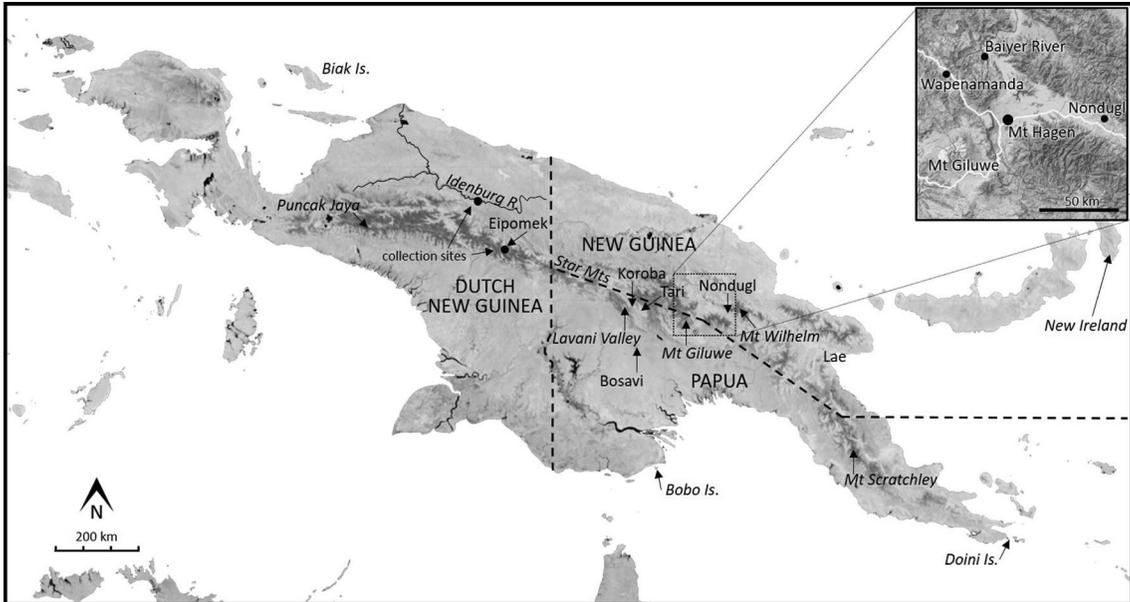


FIG 1: Mainland New Guinea showing colonial territories in the mid-20th Century and named localities.

species and insisted that use of the term ‘feral’ for this New Guinea dog was incorrect.

Troughton’s accounts of New Guinea dogs have provided historical props for assertions that a distinctive form of wild dog, variously named New Guinea Singing Dog (NGSD), New Guinea Highland Wild Dog, New Guinea Dingo, and in earlier years New Guinea Yodeling Dog, is present at scattered high-altitude locations of mainland New Guinea, isolated from places where people live and, hence, largely isolated from the village dogs associated with those people (Anon 1958, Koler-Matznick *et al.* 2007, 2016: 161-165, McIntyre *et al.* 2019). On two counts, this opinion remains controversial. Firstly, disagreement concerning the taxonomic status of the NGSD with some authors accepting the name *Canis hallstromi* Troughton, 1957 (Crowther *et al.* 2014) and others treating it, together with the Australian dingo, as *Canis familiaris* Linnaeus, 1758 (Jackson *et al.* 2017). Secondly, disagreement concerning the provenance of the founding members of the captive population as wild-living or village-living, and their status as wild, feral or domestic. Koler-Matznick *et al.* (2007:

49) wrote that the ‘current captive singing dog population is descended from eight specimens not directly caught in the wild’ and then commented that ‘this does not mean, however, that these specimens were village *C. familiaris*’. Recent genetic studies, however, using samples from the captive population, treat those dogs as descendants of wild-living forebears (Surbatki *et al.* 2020) and, in direct contradiction to Koler-Matznick *et al.* (2007: 49), Cairns (2021) asserts that most of the captive NGSD population was ‘founded by 8 individuals captured from the wild in 1950’.

Misunderstandings and misinterpretations of the historical record continue to the present time due, in part, to earlier errors and flawed assumptions being later accepted as fact. In this paper we direct attention to errors of both fact and interpretation in accounts of the NGSD with particular emphasis upon details of the provenance of specimens that were taken to be diagnostic of *C. hallstromi* Troughton, 1957 (Troughton 1957; Koler-Matznick *et al.* 2003). We show that the presumed status as wild animals, or as descendants from wild animals, of the founding members of the captive

population of NGDS is incorrect in some cases and in doubt for others. We reinforce an earlier argument that, at the time of European colonisation of New Guinea, high-altitude wild-living dogs and most village-living dogs ‘comprised a single though heterogeneous gene pool’ (Dwyer & Minnegal 2016: 9). We suggest that studies of village-living dogs throughout remote areas of New Guinea offer an opportunity to learn about what was once a pan-New Guinean population of an unusual, and archaic, form of domestic dog.

### The provenance of the Taronga Dogs

In 1954, Troughton visited the Mandated Territory of New Guinea as a collector working on behalf of the Australian Museum. He ‘hoped to obtain specimens’ of dogs from ‘Mount Giluwe [*sic*], where our host-mentor, Mr. N. E. P. Blood, had observed the dogs around villages at about 8,000 ft. on the 14,346 ft. mountain’ (1971: 96). Blood was manager of Sir Edward Hallstrom’s Livestock and Fauna Trust Station at Nondugl, in the Western Highlands District. On Blood’s advice that his safety could not be guaranteed, Troughton did not visit those villages and, thus, did not obtain dogs.

While it was clear that Troughton hoped to obtain dogs like those described from Mount Scratchley, it was not clear whether the dogs Blood had in mind were village-living or wild-living animals or, indeed, whether Blood himself knew. At that time, it was doubtful expatriate observers would have seen them as different. Anthropologist, Meggitt (1958: 299), who undertook long-term research in the region of highland New Guinea, wrote: ‘The indigenous dog is a handsome animal of stocky build and looks rather like a small dingo. Like the dingo, it howls but does not bark’. That description would have applied equally to village-living and wild-living animals (see also, Clarke 1971: 87; Healey 1990: 93). With reference to the years 1955-57, Meggitt commented that ‘few of these dogs are to be seen within several days’ walk of European settlement. Many were destroyed and eaten by their owners when they acquired fowls’. Bulmer and Menzies (1972: 486) reported

that Kalam people had killed their dogs for the same reason though, by late 1971, they again kept dogs most of which were now ‘wholly or partly of European-introduced stock’.

More than a year after Troughton had failed to obtain a New Guinea dog, Albert Speer, then a Government Medical Assistant based at Duna (later Koroba), Southern Highlands District, wrote to Sir Edward Hallstrom saying:

I have in my possession here one of the local native dogs it is a true type of the indigenous Papuan dog. It is a male pup and has been in my possession now for over one month, and is I would say only 2 months old. ... I did hear that you were anxious to obtain one of these dogs, and as I go on leave from here in August of this year, and will have to make some arrangements for the dogs welfare, I thought you might like to have it. ... If you do need it, (and I may be able to get a female also if you want them) I would be only too pleased to let you have it .... (Correspondence Speer to Hallstrom, 31 May 1956; held by authors.)

Sometime later, from Duna, Speer wrote to Ted at Tari:

Had a reply back from Sir Edward Hallstrom and he wants these two Kanaka Dogs sent over to Nondugal [*sic*], would you please see that they get away OK?

I have sent Hubert with them and he can look after them until a plane lifts them off. Would you please look after Hubert and cargo Boy for food etc? I’ve told Hubert to keep the big dog (DUNA) on the leash, however as yet he hasn’t done any damage around here. The small pup killed a chicken here. ... (Correspondence Speer to Ted, undated; held by authors.)

On 5 August 1956, Speer again wrote to Hallstrom acknowledging the latter’s thanks for the gift of the two dogs:

... you owe nothing in the way of thanks,

I on the contrary am grateful to you for accepting the dogs, and I only hope that they are of benefit to you. (Correspondence Speer to Hallstrom, 5 August 1956; held by authors.)

The two dogs that Speer gave to Hallstrom reached Sydney, by boat from Lae, in March 1957 (Anon 1957; Fig. 2). The female was already pregnant and apparently gave birth to four pups about three weeks after arrival (Anon n.d.) Available correspondence does not reveal either the provenance of these two dogs or their status as wild-living or village-living. However, Troughton (1957: 93) wrote that the two dogs held by Taronga had been obtained in 1956 by J. P. Sinclair and Albert Speer 'in the remote Lavani Valley, or so called "Shangri-La"' of the 'Southern Highlands District of Papua'. Some writers suggested that Sinclair and Speer were the first Europeans to visit the valley (Koler-Matznick *et al.* 2007: 49).

James Sinclair and Albert Speer were not the first 'white men' to visit Lavani Valley. In May 1954, John Zehnder, a geologist with the Australasian Petroleum Company, spent three days in the valley investigating rumours of surface oil leaks in the area (Clancy 1954). Zehnder's visit received considerable attention in the press and, for a time, the valley was

referred to as 'Shangri La' (Anon 1954, Simpson 1954a, Zehnder with Jones 1954).

Sinclair and Speer first visited Lavani Valley for two days in June 1955, arriving on the 26th, departing on the 28th, as part of a 62-day government patrol to populated areas northwest from Tari, Southern Highlands District (Sinclair 1955). Their patrol was not sponsored by Sir Edward Hallstrom and was not intended, even in part, as a search for dogs, wild-living or otherwise as some contend (Koler-Matznick 2018: 10). On the 27th, their only full day in the valley, Speer attended to health concerns at local communities and Sinclair, accompanied by guides and up to 70 armed men, explored the local area. These circumstances were hardly conducive to encounters with wild-living dogs. The only reference to dogs in their reports is a brief comment by Sinclair, included in a section subtitled 'Agriculture and animal husbandry', where he remarked that 'Many very good specimens of CANINE PAPUENSIS were seen, some particularly fine animals being seen in LAVANI Valley' (Sinclair 1955: 62). Except on the two days when crossing the range at 2,500 m ASL into and out of the valley, the patrol travelled between communities in a relatively well populated area.

In November 1955 Sinclair and Speer revisited the valley and spent about a month

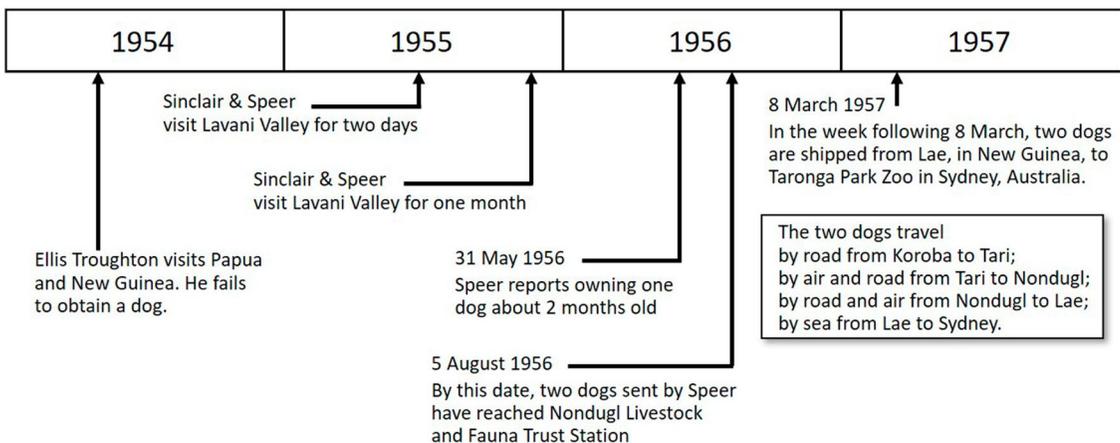


FIG. 2: Tracking the early history of the first two dogs to reach Taronga Park Zoo.

there. Speer again attended to health concerns. Sinclair spent time patrolling throughout the valley but, as on the earlier visit, was usually accompanied by large groups of men. There was no mention of dogs in his report from that month, nor was he impressed by earlier reports of a lost Shangri La (Sinclair 1956). He wrote of ‘the bitter, inhospitable nature of [the] land’ and R. R. Cole, Acting District Commissioner, commenting on Sinclair’s report, wrote that ‘the survey of Lavani Valley should now stop any further unrealistic publicity’.

Neither Sinclair nor Speer visited Lavani Valley again after 1955. The two dogs that Speer gave to Hallstrom were born more than three months after Sinclair and Speer had last visited the valley. Both were acquired by Speer during the time he was based at Duna (Koroba) as a government medical officer. His reference to them as ‘Kanaka dogs’ implies that, in his judgement, they were the kind of dogs that were kept by local indigenous people; his reference to the male as being ‘one of the local native dogs’ and ‘a true type of the indigenous Papuan dog’ reinforces this interpretation. He had, in addition, named his first dog ‘Duna’ after the place where he lived and the language spoken by local people rather than ‘Huri’ which was the language spoken by people of Lavani Valley.

It is noteworthy, that Sinclair’s only mention of dogs in Lavani Valley was under the heading of ‘animal husbandry’. He was, surely, writing of animals that were associated with people. Further, in this context, he named them ‘CANINE PAPUENSIS’, approximately two years before Troughton proposed the name *Canis hallstromi*. In earlier years, New Guinea village dogs were often referred to as ‘Papuan dogs’ in newspaper reports and the more formal rendition – *Canis papuensis* – may perhaps stem from knowledge of Mikloucho-Maclay’s (1881) usage with reference to dogs found in villages on the northeast coast of mainland New Guinea. Mikloucho-Maclay had himself adapted the name from Ramsay’s (1879) diagnosis of a coastal village dog from Papua as *Canis familiaris* var. *papuensis*.

Assertions that Sinclair and Speer obtained the dogs from Lavani Valley, and that their visit was sponsored by Hallstrom, are wrong. There is no available evidence that those dogs were either obtained from the wild or born to wild-living females. Rather, available evidence makes it more likely that they were the progeny of females that were owned by people and that lived in hamlets close to the government patrol post of Duna (Koroba). In those years, and in this region of New Guinea, people kept many dogs. In May 1939, Patrol Officer James Taylor, returning from the 15-month Hagen-Sepik patrol, paused for five days at Hoiyevia near the future location of Tari. When he departed on the 14th, his carriers ‘took over fifty puppies they had bought’ planning to re-sell them at Wabag (Gammage 1998: 199). Enroute to Wabag they camped in the mountains. The young dogs huddled together, almost frozen, until a ‘fire was lit and they thawed out. They did not bark, but now and again one would begin howling and the rest would join in making a hideous chorus of wailing until their masters bullied them into silence’ (Taylor 1939: 353). The assertions by Koler-Matznick *et al.* (2007: 49) that ‘in general, canids did not fit within the Highlander’s traditional way of home life’ and ‘most Highlanders usually did not, and still do not, keep *C. familiaris* as companion animals’ overstate the facts.

### Troughton’s 1971 Observations

In 1971, Troughton published a paper titled ‘The early history and relationships of the New Guinea Highland dog (*Canis hallstromi*)’, in which he recorded the known distribution of *Canis hallstromi* as Mount Scratchley, Lavani Valley and the Indenburg River, in what was then Dutch New Guinea (Fig. 1).

While the presence of wild-living dogs on Mount Scratchley, and elsewhere in the Owen Stanley Range, is not in doubt, it is not known whether the Queensland Museum specimens derived from village-living or wild-living animals (Macgregor 1889; Anon 1929; Murray 1912: Chapter XI; Dwyer & Minnegal 2016: 2).

Longman (1928: 155) wrote that they were 'originally obtained from the natives'.

Of more significance, however, is Troughton's (1971: 96) acceptance of information in G.H.H. Tate's (1952: 613-14) report that, during the 1939 Archbold Expedition to Dutch New Guinea, 'Mr. W.B. Richardson ... obtained five Papuan dogs at the Idenburg River'. Tate noted that in each of these dogs 'the carnassial length is more than 10 per cent of the condylo-basal length', and that Wood-Jones (1929) had taken this measure as showing that 'the Papuan dogs represented a primitive race' (Tate 1952: 614). Troughton concluded: 'Thus we have a very considerable extension of the highland range of a small dog of the same type [as that found at Mount Scratchley and Lavani Valley] in major cranial characters, from the opposite coast and beyond the border of the Territory of New Guinea' (1971: 96). Troughton failed to mention Tate's observations that the five Idenburg River dogs 'were brought into camp by natives' and 'presumably ... were domestic, not wild, animals' (Tate 1952: 614). More tellingly, Troughton also failed to mention that one dog was received at an expedition camp located at 75 m altitude and the other four were received at an expedition camp located at 800 m altitude (Tate 1952: 614; see Fig. 1 in Rand 1940: 2). Thus, Troughton himself treated dogs received at low and middle altitudes - dogs that Tate assumed to be domestic - as being of the same kind as those he had described as a wild-living species confined to high altitudes.

Troughton commenced his 1971 paper by referring to reports from 1606 of a 'barkless' dog from coastal New Guinea. Diego de Prado wrote that at San Facundo Island (Blanchard or Doini Island) in the far east of New Guinea, 'we found small dumb dogs that neither bark nor howl', and that at Isla de los Perros (Bristow or Bobo Island) the dogs howled all night, 'which caused terror' though they proved to be good eating with their flesh 'better than that of venison' (Stevens 1930: 141, 158; see also A.R.H. 1941: 97-98).

Troughton considered that 'subsequent accounts indicate that this distinctive small dog

was forced to the seclusion of a mountainous habitat by a combination of hostile circumstances'. This 'upland migration', he asserted, 'evidently occurred prior to hybridisation with any introduced breed of domesticated canine' (1971: 93). It seems that Troughton thought that this postulated 'upland migration' was very recent for he referenced reports from 1842 and 1886 in which lowland dogs were said to howl rather than bark. Troughton's flawed biogeographical reasoning has gone unremarked except by Gollan (1982: 208), who wrote that 'he uses the earliest historical reports of the coastal village dogs to validate the supposed ancient existence of the highland feral population'. Note, however, that Troughton considered the highland dogs to be 'wild' not 'feral'.

### An updated description of the New Guinea Singing Dog

In 2003, Koler-Matznick *et al.* published a detailed, expanded description of the NGSD. They supported Troughton's identification of this dog as a unique, wild-living, taxon but acknowledged that 'further studies are needed to clarify the exact level of taxonomic differentiation of this rare and possibly highly endangered canid' (Koler-Matznick *et al.* 2003: 109). Measurements from 15 skulls provide the primary basis of Koler-Matznick *et al.*'s diagnosis. Figure 3 summarises available information concerning the provenance of those skulls (Koler-Matznick *et al.* 2003, Koler-Matznick 2018).

Five of the skulls, held by the Australian Museum, originated from Taronga, and comprised those of the holotype (M.8502), allotype (M.8917) and captive-born descendants of this pair. Measurements from two skulls held by the Australian National University were included; these came from seventh generation Taronga dogs (Gollan 1982). Four skulls were derived from descendants of dogs that had been exported from Taronga to the United States of America, which were themselves descendants of the pair of dogs described by Troughton.

One skull, obtained by James McIntyre in 1996 from a village in the Star Mountains,

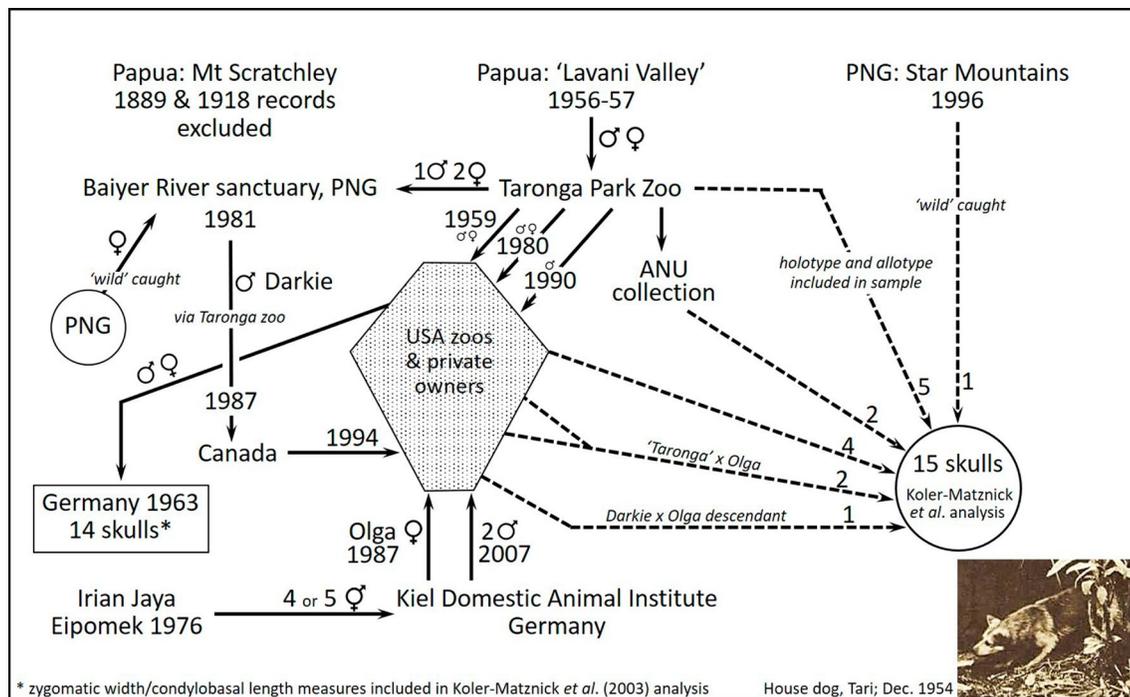


FIG. 3. The provenance of founding members of the captive New Guinea Singing Dog (NGSD) population and of specimens used to formally diagnose that dog. The photograph is from Simpson (1954b).

was reported by local people to be from a wild-living dog (McIntyre 1996). McIntyre considered that dogs living in the village were 'remarkably similar' in morphology, colouring and vocalisations to captive NGSDs (McIntyre n.d.).

In the 1970s a German interdisciplinary team initiated long-term research among Mek-speaking Eipo of the Eastern Highlands of what was then named Irian Jaya, Indonesia (Ploeg 2004). In 1976, four or five dogs from the region were relocated to the Kiel Domestic Animal Institute, Germany, for breeding and research. (Schultz & Gunter 1978, wrote that 'some' dogs were taken to Germany; Voth, 1988: 3, gave the number as four and Koler-Matznick et al. 2003: 109, referencing both sources, gave the number as five.) In 1987, Olga, a female descendant of the Eipo dogs, was sent to the United States. Two of the skulls measured by Koler-Matznick et al. (2003: 110) 'were Papuan x Irian Jaya'; from matings between male dogs of Taronga (Papuan) ancestry and Olga (Irian Jaya).

In 1981, a male dog named Darkie was born at Baiyer River Sanctuary to a male imported from Taronga and a female said to be wild-caught from the vicinity of Wapenamanda, about 25 km southwest of Baiyer River (Anon 1979, Koler-Matznick et al. 2000: 242). In 1994, Darkie reached the United States via Taronga and Canada. One skull included in the Koler-Matznick et al. (2003) analysis was born to a female descendant of Olga that had been mated to Darkie.

Koler-Matznick et al. accepted that, at the time they were obtained, the Eipo dogs were village-living. They wrote, however, that 'the Eipo tribe of the Irian Jaya Highlands kept and bred tamed NGSDs as social partners and playmates for children' (2003: 115) and, later, that the dogs taken to Germany 'had reportedly been bred by the locals' who were 'apparently one of the few traditional people who actually allowed their captive singing dogs to breed' (2007: 49). They cite Voth (1988) in support of

these assertions but have misread that source. Voth (1988: 4-7) reported information received by interview from expedition members W. Nelke and G. Koch. Nelke had spent more than two years living among the people. Voth wrote of the close relationship between Eipo people and young dogs, noting that 'adult dogs increasingly withdraw into the forest in search of food' and suggesting that 'in addition to these village dogs, fully wild dingoes presumably also live in New Guinea's primeval forests' (1988: 5). Nelke and Koch did not confirm the existence of wild-living dogs in the area. They reported, however, that local people spoke of 'solitary, black, "wild" dingoes who come into the valley occasionally from the north, and are then hunted and killed; persecution of black dogs is rooted in the people's spiritual beliefs' (Voth 1988: 6).

In addition, Voth (1988: 5) wrote that 'this Papuan tribe also practices a primitive kind of selection for external beauty; dogs with light color and well-developed white markings are preferred for breeding. When a bitch is in heat, the pair is confined in a garden hut; the tamer females often whelp there as well'. Voth is writing about a population of village dogs and not, as Koler-Matznick *et al.* (2003) contend, about wild dogs that are being bred by local people. Indeed, the colour of the dogs favoured by Eipo people is in complete contrast to the colour of dogs they assert to be wild.

In summary, the Eipomek dogs that were taken to Germany were village dogs with no known wild dog ancestors. Olga was a descendant of those village dogs. In 2018, Koler-Matznick wrote that 'today all Singers in the USA trace back to Olga on the female line' (2018: 11).

Koler-Matznick *et al.* (2003: 111, Table 1) used four measures to compare USA captive NGSDs with Thai dog, desert *Canis dingo*, *Canis aureus*, *Canis lupus pallipes/arabs*, 'Papuan dog' and Shiba Inu. Data for 'Papuan dogs' came from 13 skulls collected by Thomas Schultz-Westrum in the Mt Bosavi area (around 600 m ASL; Boessneck and Meyer-Lempennau 1969); these skulls were from village-living dogs that

had died in an epidemic. The four measures used by Koler-Matznick *et al.* were zygomatic width/condylobasal length, shoulder height, shoulder height/head-body length, and head length/shoulder height. A major difference between NGSDs and the Bosavi dogs was observed in the ratios of head length to shoulder height (NGSD 0.52-0.54; Bosavi dog 0.33-0.34). However, Boessneck & Meyer-Lempennau (1969) had not reported head lengths of the Bosavi dogs. Koler-Matznick *et al.* (2003: 111) used total skull length as an approximation, acknowledged that skull length would probably be 'slightly smaller [than head length] owing to lack of the extension of the nose pad beyond the prosthion', but did not estimate the likely resultant bias. Using their own data for NGSDs the ratio of skull length to shoulder height would be about 0.41 to 0.45, notably less than the reported ratio of 0.52-0.54. Further, Boessneck & Meyer-Lempennau (1969) had access to only skulls. Their measures of shoulder height were derived from a regression equation that estimated shoulder height in dogs from the length of the inner brain cavity of the skull (Wyrost & Kucharczyk 1967). Boessneck & Meyer-Lempennau expressed doubt about the estimates obtained. Koler-Matznick *et al.* (2003), however, did not indicate either that measures of shoulder height for Bosavi dogs were estimates or that those estimates were problematic. The comparison of NGSDs and Bosavi (Papuan) dogs reported in Table 1 of Koler-Matznick *et al.* (2003) is not reliable.

In 1963, the Kiel Domestic Animal Institute in Germany received a pair of NGSDs from the San Diego Zoo, USA. Schultz (1969) studied descendants of this pair and his measures of the ratio of zygomatic width to condylobasal length for 14 skulls were included in the Koler-Matznick (2003) analysis. In his own contribution, Schultz (1969: 66) accepted Troughton's diagnosis of these dogs as *Canis hallstromi* but argued that 'the descendents [*sic*] of the original two dogs, which were bred in Kiel, did not prove to be members of a genetically uniform population as postulated in the beginning'. He argued also that the combination of several morphological features 'as well as zoogeographical

considerations appear to justify the statement that the Hallstrom-dogs are dogs returned to a wild state'. Schultz considered wild-living NGSDs to be feral. Troughton (1971) and Koler-Matznick (2007: 48) disagreed with this opinion.

In 1979 the Museum of Berlin held an exhibition about the Eipo research project (Ploeg 2004: 37). Schultz & Gunter (1978) wrote an information sheet introducing zoological matters. In this they named the Eipo dogs as *Canis lupus f. familiaris* where, following Bohlken (1961), 'f' indicates that the 'form' *familiaris* is a domesticated wolf (*C. lupus*; see also Voth 1988: 1). In none of the publications accessed by us, have German workers treated the Eipo dogs as wild animals.

Finally, Koler-Matznick *et al.* (2003: 110) excluded the Mt Scratchley dogs from their diagnosis of the NGSD. They wrote: 'as they were apparently obtained from the indigenous people, their provenance is uncertain and they were not included'. However, in a later paper (Koler-Matznick *et al.* 2007: 48), the 1897 Mt Scratchley dog is accepted as 'the first specimen available for examination'. No explanation is offered for the change in opinion.

## DISCUSSION

The captive population of NGSDs is derived from seven or eight founding members. None was captured as a wild-living dog.

Published accounts of the history and provenance of the first pair of these dogs to reach Australia are wrong in asserting that they were obtained by Sinclair and Speer when these men visited Lavani Valley on an expedition sponsored by Sir Edward Hallstrom. Available correspondence, and details about the age of the dogs when they were given to Hallstrom, support our judgements that the dogs were obtained from people who lived in the vicinity of the government station at Duna (Koroba) and that Speer, who organised the gift to Hallstrom, considered such dogs to be the 'true type of the indigenous Papuan dog' (see photograph of house dog included in Fig. 3). In 1956, it would have been impractical, for both financial and logistical reasons, to organise an

expedition from Duna to Lavani Valley that had the express purpose of acquiring a wild dog and was not accompanied by an expatriate government officer. Further, given that wild-living and village-living dogs appeared to be phenotypically indistinguishable, the status of a dog obtained in these circumstances would be in doubt.

There is no ambiguity in accounts of the provenance and status of the four or five dogs collected from Eipo people in 1976. They were village-living dogs with no known genealogical links to wild-living forebears.

The last founding member of the captive NGSD population is the female, held at Baiyer River Sanctuary, that was mated to a male from Taronga and gave birth to the dog Darkie that was subsequently sent to USA. Though this female was said to have been wild-caught, no details of her capture and history are available and, hence, her status as a wild dog is not guaranteed. Further, in our judgement, as argued above, there is no evidence that Darkie's sire had wild-living forebears.

Troughton (1971) accepted that dogs from Mt Scratchley, the two dogs reported to be from Lavani Valley, and dogs from Indenburg River were representatives of the form he had named as *Canis hallstromi*. There is no unambiguous evidence that any of these animals was a wild dog. Troughton's own reporting contains errors and inconsistencies.

With one exception, the skulls used by Koler-Matznick *et al.* (2003) to diagnose *C. hallstromi* Troughton, 1957 were either those of founding members of the captive population (i.e., the holotype and allotype) or from dogs that were the descendants of founding members. Those with Eipo ancestry were not from wild dog stock and, in our judgement, nor were those with Taronga ancestry. The exception is the skull collected in the Star Mountains. Local people said this had come from a wild-living dog but there is no independent verification of that assertion.

There is no certainty that, at the time it was acquired by Europeans, any dog that became a

founding member of the captive population of NGSDs was either living freely as a wild dog, was a captive wild dog, or was the descendant of a captive wild dog. Similarly, there is no certainty with respect to possible status as a wild dog of any of the individuals that provided the cranial material used to diagnose *Canis hallstromi* Troughton, 1957. The skull from the Star Mountains is more likely than any of the others to be from a wild dog; skulls with Eipo ancestry are less likely than any of the others to have links to wild dogs.

Writing in 2018, Koler-Matznick (2018: 10) commented that ‘today all Singers in the USA trace back to Olga on the female line’. Olga, a descendant of the Eipo dogs, was transferred from Germany to USA in 1994 where, in addition to mating with the Baiyer River dog Darkie (Fig. 3), she ‘produced several litters sired by a San Diego Zoo/Taronga line male named Dinkum’ (Koler-Matznick 2018: 10). Some pedigreed NGSDs are fourth and fifth generation descendants of Olga and Dinkum ‘as they were the only pair reproducing for several years’ (Koler-Matznick 2018: 10). There are important implications here for recent and on-going genetic studies. The maternal genome of any new samples taken from USA captive NGSDs will presumably be derived from that of Olga, a village dog from the Eipo region with no known links to wild dogs. The precise source of NGSD samples in recent genetic studies is also in doubt (Shannon *et al.* 2015, Oskarsson *et al.* 2012, Surbakti *et al.* 2020). Oskarsson *et al.* (2012: 971) reported examining ‘three NGSDs, representing the only three known female lineages’. If appropriate genetic material from females of the Taronga and Baiyer River lineages had not been held in storage for some years then there is not a good fit between the quoted assertions of Oskarsson *et al.* and Koler-Matznick *et al.* This matter calls for clarification in future studies.

In an earlier paper we argued that ‘there is no convincing evidence that New Guinea wild-living dogs and some, or all, precolonisation New Guinea village dogs were distinct forms’ (Dwyer & Minnegal 2016: 9). The present analysis reinforces that conclusion by arguing that few,

if any, of the founding members of the captive population of NGSDs, or of the dogs that served to diagnose *Canis hallstromi* Troughton, 1957, were wild dogs or the recent descendants of wild dogs. Two important implications follow from this.

First, if the types of *C. hallstromi* were village dogs, as we argue, and the name *C. hallstromi* Troughton, 1957 refers to village dogs and wild dogs from all altitudes of New Guinea, then that name is a junior subjective synonym of *Canis familiaris novaehiberniae* Lesson, 1827. *C.f. novaehiberniae* was reported from New Ireland and Biak Island more than a century before Troughton wrote about New Guinea dogs (Dwyer *et al.* 2021).

Second, we accept the conclusion of Surbakti *et al.* (2020) that captive-bred NGSDs and the population of wild-living dogs found at high altitudes of Papua Province, Indonesia, in 2016 (McIntyre *et al.* 2019), are members of a single genetic population, allied to dingoes but distinct from breed dogs. Our argument that most if not all the captive NGSDs are derived from village-living dogs does not challenge this conclusion but, rather, extends its reach within New Guinea. Populations of village-living dogs that closely resemble NGSDs both phenotypically and behaviourally occur, to the present day, at both lower and higher altitudes throughout New Guinea, particularly in more remote regions where hunting by local people continues to be important (Dwyer & Minnegal 2016). These dogs often howl in synchrony (‘chorus howling’, Koler-Matznick *et al.* 2005: 42, 46), a vocalisation that Surbatki *et al.* 2020: 24369) assert is diagnostic of NGSDs and is unlike that of ‘any other canid population’. It is likely that these village dogs are NGSDs or retain strong genetic links to NGSDs.

Following Jackson *et al.* (2017), we consider that NGSDs – wild-living, village-living and captive – are most appropriately named *Canis familiaris* L., 1758. Within this parataxon, however, they potentially qualify as an ‘evolutionarily significant unit’ in the sense of Moritz (1994; see also Koler-Matznick *et al.* 2003: 116, Surbatki *et al.* 2020: 24369) and, for

that reason, merit special attention with respect to conservation.

Increasingly, the original gene pool of these New Guinea dogs will have been, and will continue to be, diluted through interbreeding with introduced animals. To this time, the population of high altitude, wild dogs found at Puncak Jaya, Papua Province, Indonesia (McIntyre *et al.* 2019) has provided the only opportunity for studying these dogs in a free-living situation. Additional detailed observational and genetic studies of village-living dogs throughout remote areas of New Guinea offer an opportunity to learn much about what was once a pan-New Guinean population of an unusual, and archaic, form of domestic dog.

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