

Poaching of Israeli wildlife by guest workers

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Abstract

Movement of people from third- to first-world countries frequently brings with it different, and often opposing, approaches to wildlife. About 22,000 Thai workers are currently employed in Israel, mostly in agriculture. Most of these workers originate from the poor Isaan region in northeast Thailand, where the major source of income is from agriculture, supplemented by gathering and hunting of animals. In Israel, many of them engage in illegal hunting and gathering of wildlife. At least 28 species of mammals (including six domestic ones), 25 species of birds, seven species of reptiles, three species of amphibians and various species of fish, molluscs and other invertebrates have been found mainly in traps (chiefly noose traps) laid by Thai workers. Other methods of capture used by the workers include the use of hand-held catapults, netting, the collection of bird eggs, and the gathering of slow-moving vertebrates and invertebrates. These activities have a serious deleterious effect on the wildlife in Israel.

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1. Introduction

Nature conservation is a far-sighted concept (Moore, 1987), which has been developed predominantly in affluent countries. However, most developing countries can rarely afford conservation as they see it as a luxury, generally having other priorities. As a result of this, many species are threatened by extinction in developing countries through hunting, which acts as an additional pressure in combination with habitat destruction. Hunting and gathering still provide the essential protein for many people in various developing countries, as it is an integral part of their culture. For example, wild animals, including amphibians, reptiles, birds and mammals are sold freely in food markets throughout China and Indo-China. One result of this combined pressure is that the number of threatened bird and mammal species in China, Indonesia and Indo-China ranges between 46 and 65, whereas fewer than 19 species are threatened in western Europe and North America (Anon. 2001; <http://www.redlist.org/info/tables.html>). In order to combat this public attitude towards nature conservation in developing countries, much effort has been invested by national and international bodies (e.g. WWF, IUCN, etc.).

A further associated problem is that through globalization there is in some countries a large-scale flow of people from poor countries to others with stronger economies. For example, in Britain, France and Germany, between 7 and 10%, of the population are immigrants; in Canada 17% of residents are non-Canadian, and in the USA 10% of the residents were born in other countries (Swerdlow, 2001). Migrants and guest workers moving from third-world countries to wealthier ones are now a fact of life, and accompanying them is a transfer of cultural traditions, including attitudes to wildlife, hunting and gathering. Little has been published on this subject, possibly because political correctness does not encourage scientists to report on such phenomena. However, some information does exist on this matter, as shown by the following examples.

Tens of thousands of emigrants moved to California from southeast Asia over the last 20 years, and this has had an unfortunate negative impact on the local fauna including fish, molluscs, birds, rodents, and mammals. One problem identified has been the use of gill nets and other nets to take fish from lakes and rivers, including waters containing salmon, steelhead, sturgeon and other species (Greg Laret, Chief Conservation Education and Enforcement Branch, California Department of Fish and Game, personal communication). Another problem in California has been the “beater” approach to hunt-

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ing, where large numbers of family members walk through the brush and drive out game into areas where licensed (but mainly unlicensed) hunters shoot animals in excess numbers (Morgan Wehtje, California Department of Fish and Game, personal communication). In Wisconsin, Hmong immigrants from Laos come from a tradition of hunter/gatherers, where there is no system of conservation law or seasonal limitations on hunting. Consequently, there have been many violations of hunting laws covering the shooting of songbirds, ducks, squirrels and deer (Steve DeWald, Warden Supervisor, Division of Natural Resources, Wisconsin Wildlife Department). Similarly, in Western Australia there have been many problems regarding illegal or excessive take of fish, shellfish and crustaceans (abalone, lobster and crab) by immigrants (Harry Recher, McCown University, Western Australia, personal communication). Also, in Washington State, recent Asian immigrants have been observed removing entire populations of limpets and even barnacles from rocks (Kristin Berry, US Geological Survey, Riverside, California, personal communication).

Southeast Asian immigrants are not the only immigrants importing their hunting traditions to their new homelands. Immigrants from European countries may also be involved. Italian and Greek immigrants to Australia were involved in the large-scale hunting of birds after the Second World War (Eleanor Russell, personal communication) and recent Russian and Korean immigrants to the USA have been involved in illegal hunting of deer (for meat) and bear (for medicinal purposes; Michael Stanner, personal communication).

1.1. *The Israeli situation*

All wildlife in Israel has legal protection and hunting is allowed only for animals that are either classified as agricultural pests or are common (Mendelssohn and Yom-Tov, 1988). To hunt these common species, a permit is issued on an individual basis for the short annual hunting season. Unlike other countries in the Mediterranean region, hunting is not a common practice in Israel and the number of licensed hunters is relatively small (only 3735 licenses in 2000, about 0.05% of the population). Moreover, the average annual number of prosecutions against perpetrators of hunting offences between 1995–2000 was 202 per year (range 145–262), and the majority of these prosecutions were against licensed hunters (Dr. Eliezer Frankenberg of the Nature Reserve Authority of Israel (NRA), personal communication). The rangers of the NRA were apparently capable of controlling poaching to such an extent that between 1965 and the 1990s many animal populations increased (Mendelssohn and Yom-Tov, 1988).

Israel is an immigrant country that during the 1990s absorbed almost one million new immigrants, as well as

an estimated 200,000 legal and illegal foreign workers (Statistical Abstracts of Israel, 1999; Fisher, 1999). In the early 1990s, Israel started to bring in agricultural workers from Thailand and at present there are ca. 22,000 such workers, mainly on 2-year contracts. There are few other groups of guest workers employed in agriculture in Israel, although there are occasionally a small number of Chinese workers. The large majority of guest workers are male. They have an excellent reputation for efficiency and hard work, and they are employed on most farms throughout the country. Most of these workers originate from the poor Isaan region in northeast Thailand, where the major source of income is from agriculture, supplemented by gathering and hunting of animals (Cohen, 1999).

During the past 10 years, anecdotal evidence has suggested that some of these Thai workers in Israel are engaged in illegal hunting and gathering of wild, and sometimes domestic, animals (Society for the Protection of Nature in Israel, 2000). Traps that have never been found before in Israel have appeared in various places, with a wide range of wild and domestic animals caught in them. During 1996–1997, many articles appeared in the Israeli press describing hunting of wild animals, as well as domestic animals, by Thai workers (Cohen, 1999). Some of the hunting by these workers appears to be for the purpose of supplementing their diet, mainly by those on a meagre salary. However, even workers who have decent living conditions, such as those living and working on Kibbutzim, have been found engaged in hunting and gathering, apparently as both a hobby and a way to vary their diet. Following the discovery of poaching by Thai workers, each one is now issued with a contract warning that hunting is not permitted in Israel, and that offenders will be extradited. However, this penalty has rarely been enforced, and generally law enforcement among Thai poachers is poor.

During the early 1990s, concurrent with the start of the employment of Thai workers in Israel, a decline was noticed in the population size of several species of wild animals. For example, an isolated population of the wild boar (*Sus scrofa*), which inhabited an area south of the Dead Sea (Fig. 1) and numbered several hundred animals during the 1980s, disappeared almost completely. Moreover, during a 3-year study of the wolf (*Canis lupus*) in the Golan Heights (Fig. 1), 18 animals were radio-collared, and four (22%) of these were found in noose traps, allegedly laid by Thai workers (A. Reichman, personal communication).

1.2. *Aim of this study*

There is clearly a conflict between the cultures of developed and developing countries, and this is borne out by the potential negative effect of hunting by these workers on animal populations in Israel. Here I attempt

to document the types of trapping involved, and to assess the potential impacts of hunting by immigrant workers on wildlife populations in Israel. This aim is achieved through an attempt to determine the number of traps laid and the species affected by poaching. The paper is not a collective accusation of these workers, but rather an indication of a phenomenon that is widespread among them.

2. Methods

Data on poaching methods and extent were gathered by a survey conducted for 65 days during July–September 2000. Three workers divided the country into three individual regions where they visited different locations. At each location the worker was paired with a local ranger of the NRA or another person. A total of about

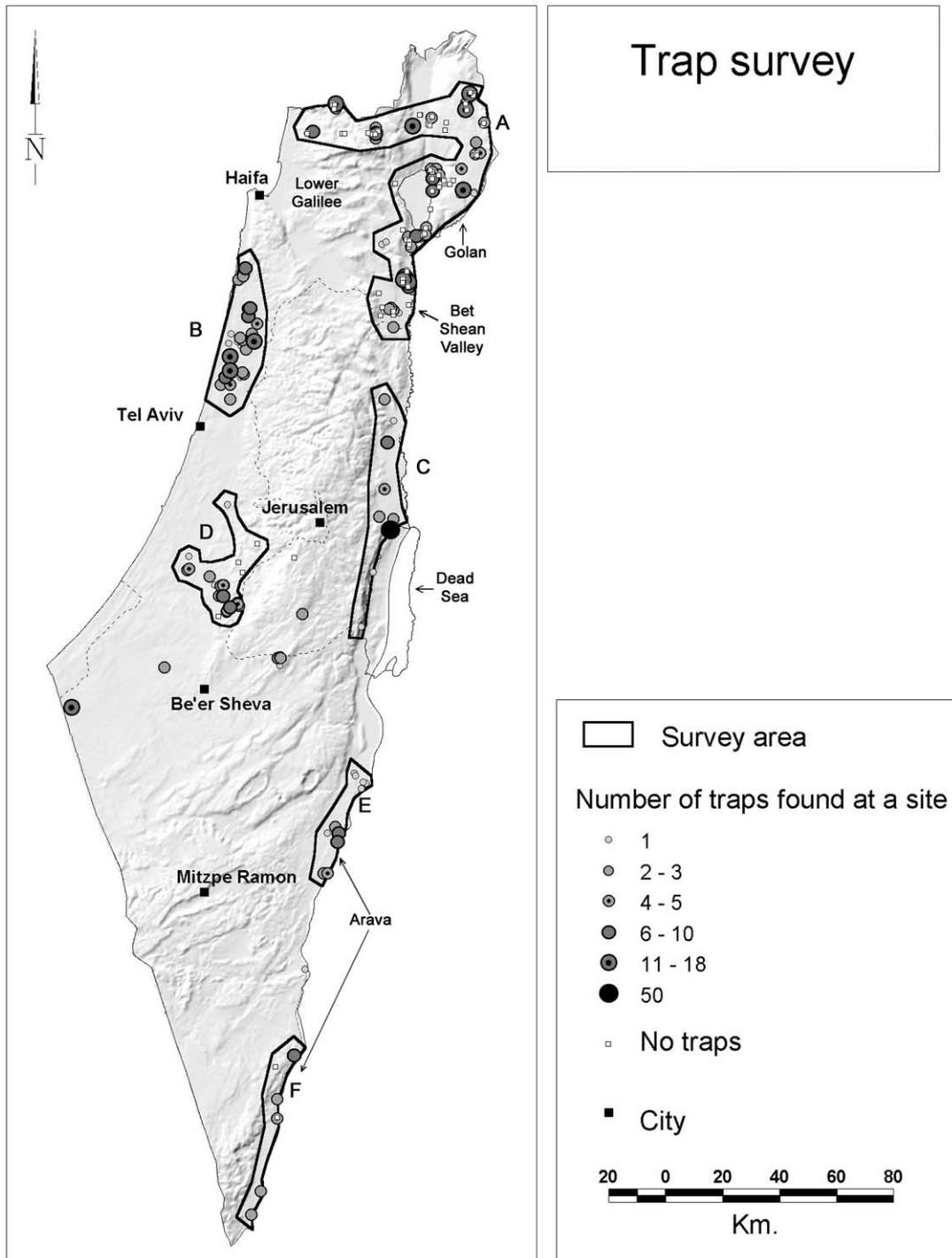


Fig. 1. The areas covered in the trap survey in Israel. The number of traps found is marked.

40 persons participated in the survey. The survey was carried out in six regions in Israel (areas A–F, Fig. 1) by driving a car along roads and fences erected in and around agricultural areas, mainly in orchards, plantations and irrigated areas where vegetables and flowers are grown. A pair of observers, one of whom drove the car slowly while the other searched for traps, surveyed each section. The search was conducted either from the car or on foot in areas of dense vegetation. Notes of the following details were made: (a) date, (b) place and (c) duration of survey (d) type of crop, (e) presence or absence of fence, (f) type of traps found, and (g) signs of animal activity in or near the traps (tracks, fur, carcasses, etc.). All traps were removed and any animal remains were taken for identification. We found that surveys carried out by two persons were 2–5.6 times more effective than those carried out by one person.

In addition, a group of three workers, together with NRA rangers, conducted a 10-day search in and around the homes of potential hunters to detect traps and hunting equipment.

3. The types of trapping involved

On three days, 10, 13 and 14 September 2000, searches in 17 houses of Thai workers in several agricultural settlements across the Mediterranean coastal plain yielded 13 noose traps, 27 hand-held catapults, seven wire box traps, a net for catching hares (*Lepus capensis*), 13 nets for catching fish and amphibians and various materials to produce the above. Some of the traps and nets were in the process of production. Others were ready for use, or even contained animal remains indicating that they had already been used in the past. In addition, we found skulls of a golden jackal (*Canis aureus*), a wild boar and a badger (*Meles meles*), as well as feathers of a hoopoe (*Upupa epops*), all of which are protected species (Amir, 2000). Searches in this, and other, regions have yielded similar results. The following is a description of the various traps and other means of hunting that were found in these searches.

3.1. *Noose traps (snares)*

Noose traps comprised more than 90% of traps found. These traps were made from many types of material, and reflected what was available. Nooses were made from iron, steel, copper, telephone cables and wires of various diameters ranging from 1 to 8 mm, as well as plastic twine used for binding hay. These traps were sometimes placed at the entrances to animal burrows. However, most were placed in either existing, or purpose-made, paths below fences, or in channels in dense vegetation. They were usually anchored at one end to a fence, pole, tree or other firm object. Some-

times a wide opening in a fence or hedge was narrowed by vegetation, stones and other means, helping to direct the animals toward the trap.

These noose traps were aimed mainly at mammals, but some were devised to capture birds. Bird traps were made chiefly from thin nylon thread hung from steel wire bent to form an n-shape opening and stuck in the ground. Such traps were laid in paths below trees and bushes, or sometimes in shallow water (to catch ducks and waders) with the noose above water and baited at one end. Nylon nooses were sometimes laid on the ground around bait, which could be either food (grain, pieces of bread) or water pools. Artificial water pools were made in some places by covering a depression in the ground with a polyethylene sheet and filling it with water. Such pools are very attractive for small to medium-sized birds, especially during the hot and dry Israeli summer. These traps were aimed at rock pigeons (*Columba livia*), turtle doves (*Streptopelia turtur*), laughing doves (*S. senegalensis*), collared doves (*S. decaocto*), chucker partridges (*Alectoris chukkar*), sand partridges (*Ammoperdix heyi*), francolins (*Francolinus francolinus*), stone curlews (*Burhinus oedipnemus*) and plovers, particularly the spur-winged plover (*Vanellus spinosus*).

Noose traps were sometimes hung from a tree branch or a wire tied to a tree, with openings at a height suitable to capture partridges or hares that come to rest beneath the tree. Such resting places often featured several traps, sometimes 12 or more at one place. Some noose traps were tied to a long flexible branch bent down to hold the noose and held precariously in position by a piece of wood. When the prey became caught in the noose, the branch released and the animal was hung in the air.

Noose traps are not selective, and many species of animals were found in them, including 19 species of mammals and 13 bird species (Table 1). Any animal attempting to pass through, or step on, such a trap is caught by the noose, which tightens around its neck, chest, abdomen or leg. During the ensuing struggle to free itself, the noose tightens. This results in suffocation and/or deep wounds, which often expose bone. In our study, many of the traps were old and had not been checked at all. Even some of the relatively recent ones had been checked infrequently, leaving the trapped animal to die.

3.2. *Other types of trap*

Box traps were most common. These were, made of a metal frame covered with metal wire, with a door connected by a wire to the bait (fruit or vegetables for herbivores, meat for carnivores), or to a footboard inside the trap. Such traps came in various sizes, ranging from those used to catch rodents to a large (1.5×1.5×2 m) trap used to capture wild boar and found south of the

Table 1
Species found in traps and caught by other means during the survey. Gathering includes collecting bird eggs

Species		Noose traps	Other traps	Nets	Hand-held catapults	Gathering, digging, etc.
Mammals						
Wolf	<i>Canis lupus</i> L.	+				
Golden jackal	<i>Canis aureus</i> L.	+	+			
Domestic dog	<i>Canis familiaris</i> L.	+	+			
Red fox	<i>Vulpes vulpes</i> L.	+	+			
Jungle cat	<i>Felis chaus</i> Guldenstaedt	+				
Wild cat	<i>Felis silvestris</i> Schreber	+				
Domestic cat	<i>Felis catus</i> L.	+	+			
European badger	<i>Meles meles</i> L.	+				
Otter	<i>Lutra lutra</i> L.	+				
Egyptian mongoose	<i>Herpestes ichneumon</i> L.	+	+			
Striped hyaena	<i>Hyaena hyaena</i> L.	+				
Hyrax	<i>Procavia capensis</i> Pallas	+				
Wild boar	<i>Sus scrofa</i> L.	+	+	+		
Mountain gazelle	<i>Gazella gazella</i> Pallas	+				
Goat	<i>Capra hircus</i> L.	+				
Cow	<i>Bos taurus</i> L.	+				
Water buffalo	<i>Bubalus bubalis</i> L.	+				
Donkey	<i>Equus asinus</i> L.	+				
European hedgehog	<i>Erinaceus concolor</i> Martin				+	
Long-eared hedgehog	<i>Hemiechinus auritus</i> Gmelin				+	
Ethiopian hedgehog	<i>Paraechinus aethiopicus</i> Ehrenberg					+
Hare	<i>Lepus europeus</i> L.			+		
Porcupine	<i>Hystrix</i> Kerr	+	+			
Nutria	<i>Myocastor coypu</i> Kerr			+		
Tristram's jird	<i>Meriones tristrami</i> Thomas					+
Fat sand rat	<i>Psamomys obesus</i> Cretzschmar					+
Pest rat	<i>Nesokia indica</i> Gray and Hardwick					+
Mole rat	<i>Spalax ehrenbergi</i> Nordmann					+
Birds						
Kestrel	<i>Falco tinnunculus</i> L.		+			
Cattle egret	<i>Bubulcus ibis</i> L.				+	
White stork	<i>Ciconia ciconia</i> L.	+			+	
Rock pigeon	<i>Columba livia</i> Gmelin	+			+	
Turtle dove	<i>Streptopelia turtur</i> L.	+			+	
Laughing dove	<i>Streptopelia senegalensis</i> L.	+			+	
Collared dove	<i>Streptopelia decaocto</i> Frivaldszky	+			+	
Chukkar partridge	<i>Alectoris chukkar</i> Gray	+			+	
Sand partridge	<i>Ammoperdix heyi</i> Temmink	+			+	
Francolin	<i>Francolinus francolinus</i> L.	+			+	
Sand curlew	<i>Burhinus oedienemus</i> L.	+				
Grey crane	<i>Grus grus</i> L.	+				
Shelduck	<i>Tadorna tadorna</i> L.				+	
Mallard	<i>Anas platyrhynchos</i> L.	+			+	
Moorhen	<i>Gallinula chloropus</i> L.	+			+	
Little owl	<i>Athene noctua</i> Scopoli				+	
Hoopoe	<i>Upupa epops</i> L.			+		
Syrian woodpecker	<i>Dendrocopos syriacus</i> Hemprich and Ehrenberg			+		
Spur-winged plover	<i>Vanellus spinosus</i> L.	+		+	+	
Stilt	<i>Himantopus himantopus</i> L.				+	
House sparrow	<i>Passer domesticus</i> L.			+		
Spanish sparrow	<i>Passer hispaniolensis</i> Temmink			+		
Yellow-vented bulbul	<i>Pycnonotus xanthopygos</i> Hemprich and Ehrenberg			+		
Arabian babbler	<i>Turdoides squamiceps</i> Cretzschmar			+		
Blackbird	<i>Turdus merula</i> L.			+		
Reptiles						
Soft-shelled turtle	<i>Trionyx triunguis</i> Forskal		+		+	
Terrapin	<i>Mauremys caspica</i> Valenciennes		+		+	
Tortoise	<i>Testudo graeca</i> Forskal				+	
Agam lizard	<i>Agama stellio</i> Haas				+	

(continued on next page)

Table 1 (continued)

Species		Noose traps	Other traps	Nets	Hand-held catapults	Gathering, digging, etc.
Spiny-tailed lizard	<i>Uroinastix aegyptius</i> Forskal	+			+	
Monitor lizard	<i>Varanus griseus</i> Daudin	+			+	
Water snake	<i>Natrix tessellata</i> L.		+		+	
Amphibians						
Frog	<i>Rana ridibunda</i> Pallas		+		+	
Toad	<i>Bufo viridis</i> Laurentius		+		+	
Tree frog	<i>Hyla arborea</i> Audouin		+		+	
Molluscs						
	<i>Osilinus turbinatus</i> Von Born				+	
	<i>Unio manachus</i> Bourguignat				+	
	<i>Osilinus turbinatus</i> Von Born	+				
	<i>Unio manachus</i> Bourguignat	+				
	<i>Unio terminalis</i> Lea	+				
Crustaceans						
	<i>Eriphia verrucosa</i> (Forsk.)	+				
	<i>Ocypode cursor</i> (L.)	+				
	<i>Potamon potamios</i> (Olivier)	+				

Dead Sea. Similar traps were used to capture aquatic, or semi-aquatic, mammals such as nutria (*Myocastor coypu*) and otter (*Lutra lutra*), water snake (*Natrix tessellata*), soft-shelled turtle (*Trionyx triunguis*), terrapin (*Mauremys caspica*), and fish. This type of trap is immersed in the water in small streams and canals, with vegetation or stones surrounding it so that when the animals are driven towards it (by people walking in the water) they are forced to enter the trap.

Glue traps, usually used to catch rodents, have also been found in use for catching birds. In one case (in the western Negev, 21 November 2001), a cardboard trap with a house mouse (*Mus musculus* L.) glued to it was placed on a pole in an open field. The mouse attracted a kestrel (*Falco tinnunculus*), which became glued to the same trap. The Thai worker who admitted placing the trap claimed that he caught the bird in order to keep it as a pet (Amizur Boldo, personal communication).

3.3. Active hunting and gathering

3.3.1. Hand-held catapults

Hand-held catapults, mostly made of Y-shaped twigs and rubber bands were commonly found. Many Thai workers regularly carry them, and they are very skillful in using them to shoot stones or small metal balls at small to medium-sized birds and reptiles over distances of 10 m or more. A list of 21 species of bird that have been killed by catapult is provided in Table 1. Most of these species are common in Israel.

3.3.2. Driving animals into target-killing areas

A common practice for hunting medium (hare), to large (wild boar), animals is to drive them into a trap or

net where they can be killed by hand-made spears (with one to four points), or knives. This was usually done in orchards, where pruned branches arranged in a trapezoid formation close escape routes. At the narrow end of the trapezoid, the hunters dig a pit, which is covered by vegetation. In this, either: (a) sharp, pointed metal wedges are embedded in the ground, (b) plastic nets are hung in which the animals become entangled, or (c) metal noose snares are hung. These traps were found mainly in central Israel, where orchards are common (Yair Sharon, personal communication). These pits are also dangerous to humans, and there is documented evidence of one person being seriously injured after falling into such a pit, by a sharp metal wedge that penetrated his leg. Often the hunters erect the nets or nooses only shortly before the hunt, and remove them afterwards, but the trapezoid arrangement and its animal remains indicate the existence of hunting.

3.3.3. Gathering

Slow-moving animals can simply be gathered by walking. In northern and central Israel, groups of up to six Thai workers were observed walking in line, gathering any animal that they passed. Animals collected in this way include: European hedgehogs (*Erinaceus europaeus*) and long-eared hedgehogs (*Hemiechinus auritus*), tortoises (*Testudo graeca*), Agama lizards (*Agama stellio*) and other reptiles (skinks, lizards and snakes) (Amizur Boldo, personal communication). In aquatic habitats, the species include: amphibians (toads *Bufo viridis*, frogs *Rana ridibunda* and tree frogs *Hyla arborea*, crustaceans such as *Potamon potamios* and bivalves (mainly *Unio manachus* and *U. terminalis*). Middens with hundreds of these bivalves each are found

along the shores of the Sea of Galilee (Avital Gazit, personal communication), as well as in the Jordan and Bet Shean Valleys, where the animals are cooked and eaten on the spot (Amizur Boldo, personal communication). Also, in the Jordan and Bet Shean Valleys, NRA rangers have caught Thai workers with buckets filled with eggs of spur-winged plovers and stilts (*Himantopus himantopus*), and while collecting eggs from nests in egret and heron colonies (Amizur Boldo, personal communication). Groups of workers have often been seen along the Mediterranean shores of Israel collecting all and any animals from small water pools in the rocky shore, including: small fish, crustaceans (mainly *Eriphia verrucosa* in the rocks and *Ocy-pode cursor* in the sandy shore), and molluscs (mainly *Osilinus turbinatus*) (Raz Amir and Uzi Paz, personal communication). In the process of collecting, they use iron rods to remove them from the rocks, thus also destroying the habitat.

Rodents weighing 100 g or more, such as Tristram's jird (*Meriones tristrami*), fat sand rat (*Psammodromus obesus*), pest rat (*Nesokia indica*), and mole-rat (*Spalax ehrenbergi*) are dug from the ground or driven out of their burrows with water. Near agricultural settlements in the Negev desert, relatively large monitor lizards (*Varanus griseus*) and other animals weighing up to 3 kg, as well as the Ethiopian hedgehog (*Paraechinus aethiopicus*) are collected. The spiny-tailed lizards (*Uromastix aegyptius*) have been almost wiped out in large areas near agricultural settlements in the Arava Valley, having been caught in noose traps placed around the opening of their conspicuous burrows. In one recent case (June 2001) in the northern Arava Valley, a soldier reported seeing a hunter riding a bicycle several km away from the nearest agricultural settlement carrying two large specimens of spiny-tailed lizards (Amizur Boldo, NRA, personal communication). This lizard was quite common until the 1990s, but today it is hardly observed at a radius of 10 km from any settlement. In one case, three Thai workers were caught near Mount Carmel while collecting frogs using home-made hooks baited with meat.

3.3.4. Netting

Many types of net are used to catch animals on land and in water. The nets are either bought or hand-made from various materials available at farms. We found in both the homes of Thai workers and in the fields, nets made from plastic sheets intended to shade crops, from plastic potato sacks, and from sacks made to protect palm dates from bats. Hand-made nets constructed of various sorts of plastic netting tied around a metal or strong plastic frame were also found in the Bet Shean Valley as well as along the Mediterranean coastal plain. The above nets were used mainly to capture aquatic or semi-aquatic animals by dragging the nets in streams,

canals and rivers, or leaving them in the water for collection later. Such nets were used to catch fish and amphibians (toads *Bufo viridis* and frogs, but also water snakes, soft-shelled turtles and terrapin (Y. Sharon, personal communication).

Some nets were hand-made and used to capture land animals. These were funnel shaped, about 1 m in diameter, loosely hung on a metal wire frame and placed between rows of plastic covered crops (mainly vegetables). The vertical strings at each side of the net were tied to a metal ring fixed to the ground on a pole. People walking towards animals (hares and chukkar partridges) drive them along the rows, and when the animal hits the net it closes around them. The hunter then collects the animal. In summer 2000 a ranger observed the hunting of a hare near Yavniel in the Lower Galilee (Amizur Boldo, personal communication), while in other cases the nets were only found in fields.

Thin threads of nylon or cotton are used to produce fine nets, similar to commercial mist nets, and are used for capturing small, mainly passerine, birds. Such nets were found in the process of being made in several places where the workers live, and were also observed in operation while hung in orchards.

4. The number and density of traps

The number and density of traps found in the survey is shown in Table 2. Although traps were found in agricultural areas throughout Israel, there was a considerable variation in density among the localities surveyed. The greatest density was found in a date palm plantation north of the Dead Sea (Fig. 1), where 50 traps (half of which were old) were found along a 3-km stretch, but high densities (more than two traps/km) were found at various localities in all regions. However, there were also some localities where no traps were found (Fig. 1). Trap density does not seem to depend on the crop type, and varied greatly from place to place.

Table 2
Trap densities in July–September 2000 in three regions of Israel (see Fig. 1 for regions and localities)

Region	Days	Localities	Total km	New traps		Old traps	
				Total	Density traps/km	Total	Density traps/km
North	25	168	148	139	0.94	117	0.79
Center	9	33	22	53	2.43	27	1.23
South	31	41	331	109	0.33	138	0.42
Golan	NA	4	19	37	1.95	NA	NA

All the results are of surveys carried out jointly by two observers along roads in agricultural areas. Data from a survey carried out by NRA rangers in the Golan Heights during February 2000 (Pevzner, 2000) are also provided for comparison. "New traps" are those which were found operative irrespective of their actual age, "old traps" are those found inoperative. NA—not available.

4.1. Rate of trap laying

All traps found in the survey were collected, and in several places the surveyors re-checked the same areas again within 14 days. Repeat visits were made along 55 km in northern Israel; 21 new traps were found, a density of 0.38 traps/km. In central Israel, a 0.8-km stretch of road was checked and five traps were found along it. A week later it was checked again and seven more traps were found. In southern Israel few new traps were found on repeat visits, and those may have been traps that were missed the first time. The rate of trap renewal appears to be high in northern and central Israel, where the original trap density may be regained within several weeks, but is much lower in the south. Skeletons and carcasses of animals (hyaenas, golden jackals, red foxes, wild boars, domestic dogs and even a cow (*Bos taurus*) were found in traps, providing evidence that some traps are unattended by the poachers. The number of traps currently present in Israel reflects an accumulation of traps laid by a large number of individuals over the last 10 years

4.2. Trap density

Trap density was 0.94, 2.43 and 0.33 traps/km in the northern, central and southern irrigated areas, respectively (Table 2), contrasting with the estimate of 1.95 traps/km in a pilot survey by NRA rangers in the Golan (Pevzner, 2000).

4.3. Estimating the number of traps in Israel

The number of traps in Israel was estimated for three areas under irrigated agriculture (Fig. 1). This was done crudely by multiplying trap density in each region by the length of agricultural roads in this region, assuming that mean density measured is the same throughout. The length of roads under irrigated agriculture in Israel was calculated by assuming: (a) that each of the three irrigated areas formed a square, and (b) that internal irrigation and access roads dissected the areas on a 100 m grid. The areas of irrigated agriculture (orchards, plantations, vegetables and flowers) in Israel in 1997 occupy 996, 392 and 821 km² in the northern, central and southern (including some in the occupied areas) regions, respectively (Statistical Abstracts of Israel, 1999), with a side length of the square of 31.56, 19.81 and 28.65 km. The total length of roads within each square was then calculated using this equation:

$$T = 2 \times 10L^2 + 2L$$

where T is the total length of road within the square and L is the length of the side of the square in km. Thus, I estimate (1) the total length of agricultural roads in the irrigated areas to be 19,983, 7889 and 16,455 km, and

(2) the total number of traps to be 18,784, 19,170 and 5430, in the northern, central and southern regions, respectively. The total number of traps in these three irrigated areas of Israel is therefore about 43,400.

5. Discussion

5.1. Methodological problems

I accept that this method of survey has some limitations and shortcomings. Here most surveys were conducted along the edge of plantations and fields, and rarely inside agricultural areas, where the density of traps may be different. Traps laid inside dense vegetation are often well concealed and are thus probably under-represented here. Finally, different observers participating in the survey may have had different capabilities of discerning traps. Nevertheless, this survey gave a first approximation to the scale of the problem.

However, there are several reasons to believe that the estimates of trap numbers may be a conservative one. First, in the calculation of trap numbers the agricultural areas are not a uniform square, but are formed of many small plots, thus considerably increasing the actual length of roads. Second, road density in certain crops (vegetables and flowers) is higher than estimated above. Third, the earlier calculation does not include traps along fences in non-crop land such as grazing grounds and around settlements. Grazed areas in the northern region had many traps (1.48 traps/km) and many traps have been found along the fences surrounding the 700 agricultural settlements in Israel, each with a length between 1 and 3 km. Fourth, the calculated mean density of 0.94 traps/km in the northern region may be too low, as it was about half the density found in the survey by NRA rangers in the Golan. Fifth, we may have missed several traps in the searched areas. Finally, it is also possible that the roads sampled here were in areas where trap density was greater than the average, although there is no evidence to support this. Thus, I suggest that the evidence shows a significant problem for nature conservation, which our data probably underestimates.

5.2. The scale of the problem

Emigrants and guest workers from developing countries often bring with them customs that are not compatible with the conservation laws in their new countries. Hunting and gathering of animals is a part of their culture, and wild animals are a part of their diet. Poaching is a widespread problem in home territories of immigrants from underdeveloped countries, even in national parks and nature reserves. For example, poaching has decimated all mammal species in the Comoe National Park, Ivory Coast (Fischer and Lin-

senmair, 2001), and affected large ungulates in Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries in Thailand (Sompoad 1993; Sompoad and Varavudh, 1995), Asian elephants (*Elephas maximus*) in Mudumalai National park (Paulrai and Subramanian, 2000) and Nilgiri tahr (*Hemitragus hylocrius*) in Anamalai Wildlife Sanctuary in India (Charudutt and Johnsingh, 1998). In Israel, poaching by Thai agricultural workers has been found to be a very common phenomenon almost everywhere. Snares are the main type of trap used in south-east Asia to hunt carnivores, deer and other ungulates, including elephants (i.e. Rabinowitz et al., 1995).

Within Israel, the differences in density among the regions may have several reasons. The main factors seem to be lower animal density in the drier southern region of Israel, a shorter agricultural season, and hence fewer workers. The high trap density found in central Israel is due to the large vegetable growing area there, which uses a large immigrant labour force. In this area the survey was carried out mainly on foot.

Although poaching by Thai workers is widespread, no study has been carried out to quantify its effect on a particular species. However, there are several examples that demonstrate that poaching may have a serious and deleterious effect on several species. The isolated population of the wild boar, which inhabits an area south of the Dead Sea, numbered several hundred animals during the 1980s. It almost completely disappeared during the 1990s, and this reduction has been ascribed to the increased use of metal noose traps. Potential effects on the wolf and spiny-tailed lizards have also been identified.

There is growing evidence that the above phenomenon is not unique to Israel, and that emigrants from southeast Asia to the USA and Australia are also engaged in illegal hunting using methods inconceivable by local poachers. Such poaching may have had an immense negative impact on local fauna including fish, molluscs, amphibians, reptiles, birds, rodents, mammals and anything else that can be trapped or caught.

5.3. Reaction of the authorities and farmers to poaching

5.3.1. Nature Reserve Authority

Employees at the NRA are capable of dealing with the relatively small extent of poaching by Israeli residents, but this duty is only one of their many tasks. There are fewer than 4000 licensed hunters in Israel, but the sudden influx of hundreds, if not thousands, of potential poachers has put strong pressure on the NRA's capabilities. Until the present survey was conducted, few of the rangers were aware of the scale of the new threat, and even those who were aware of it cannot allocate enough time to tackling the problem. The reasons for this are twofold: a large workload, and a deep frustration caused by the lack of effective punishment for offenders.

Catching poachers who use traps (in contrast to guns) is not simple. A trapper can only be prosecuted when actually laying the trap or removing a captured animal from it. Observing a trapper close to a trap is insufficient to prove guilt, and trappers are very careful not to approach their traps when a ranger is in sight. Hence, before January 2000 there were few cases in which a trapper was caught, and even in those cases prosecution was slow (Roni Malka, Head, Law Enforcement Branch, NRA, personal communication). In spite of the inclusion of a clause in each Thai worker's contract stating that poaching will result in immediate expulsion, this threat has rarely been carried out. It is now more than 10 years since the problem was first identified, and until summer 2000 the NRA did little to deal with the problem other than to distribute leaflets in the Thai language to the workers warning of the consequences of poaching. Since the threatened punishments were rarely carried out, this has had little effect.

In February 2000, a pressure group of over 50 academics from all the universities in Israel wrote a joint letter to the NRA and several government ministers, expressing their concern over the threat posed by poaching by Thai workers to Israel wildlife. This was followed by publications in the media, which resulted in more activity by the NRA. In spring 2001, there was some improvement after more than a year of negotiations; the NRA established a procedure, in co-ordination with the police and the Ministry of the Interior, to expel offenders who are caught red-handed. Three poachers have been expelled since the establishment of this procedure, after having been caught hunting birds and terrapins. In June 2001, a special ranger was appointed to co-ordinate the activity of rangers in law enforcement among Thai workers. Within 4 months, 19 Thai workers were caught either laying traps or handling protected animals. Six of these workers were expelled, the rest have been prosecuted and were either fined or are awaiting expulsion (Mati Koronio, Chief Enforcement Officer, NRA, personal communication).

5.3.2. Thai officials

During February 1997, the Thai Minister of Employment, visited Israel and was asked by a journalist for his reaction to the allegations that Thai workers are engaged in illegal hunting. The minister replied that although hunting is an integral part of the Thai culture, a solution had to be found (Enosh, 1997). During a meeting in February 2000 between the Thai ambassador to Israel, the chairman of the scientific committee, the NRA and myself, the ambassador initially proclaimed his disbelief that Thai workers could carry out large-scale hunting, and stated that the embassy explains to the workers that they must not hunt in Israel. When faced with evidence of the hunting, however, he did acknowledge its existence, but considered it to be of

small scale and a consequence of the poor living conditions of the workers. During tours with the NRA, the ambassador was shown the true scale of the problem. However, action taken by the Embassy appears to have made little difference the workers' actions.

5.3.3. *Farmers*

Most farmers are apathetic to poaching by their workers, although they have the ability to reduce it considerably. Some of the farmers even encourage their workers to hunt, both as a way of reducing damage to crops by wild animals, and as a means of "leisure activity" for the workers. It is very difficult to prosecute such farmers, as workers are afraid to give evidence against their employers, some of whom have even concealed evidence of hunting by their workers.

Although most workers live close to their employers, some are housed in remote places in the farmed area. Living conditions in such places are often squalid, without electricity and other basic conditions. Workers in such places tend to engage in poaching, and searches there yielded many more traps, catapults, nets and other means of hunting than in houses within farms (Dadi Kabasa and Raz Amir, NRA, personal communication).

6. Conclusions

Unfortunately, Western conservation laws appear to be having little deterrent effect on many immigrants and guest workers from southeast Asia. Solutions to this problem lie in improved education as well as a general improvement in the living conditions of guest workers. As this is likely to be a long-scale solution, a short-term solution is needed and this lies in broadening and enforcing the law. Otherwise many species of wildlife in Israel and elsewhere may be reduced beyond the minimum size for survival.

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