

NEWS FROM ACADEMY BAY

SEA CUCUMBER FISHING BOAT CAPTURED

A recent control operation within the Biological Reserve of Marine Resources of Galapagos was successful. On Sunday, 2 March 1997, an overflight was conducted by the Acting Director of the Galapagos National Park Service (GNPS), Edgar Vargas, confirmed the presence of an illegal camp on northern Isabela and several small boats carrying out suspicious activities.

With this background, and in coordination with the Port Captain of Puerto Ayora, the GNPS launch *Guadalupe River* left Puerto Ayora with Park and Navy personnel on board. On 4 March, a camp was found on western Isla Isabela with 5,000 dried sea cucumbers. Personnel proceeded to confiscate various elements that serve in the processing of sea cucumbers and also cleaned all the garbage that was found at the site. The people in the camp managed to escape upon hearing the sound of the launch *Guadalupe River*.

On 5 March, another camp, this one with 22,000 dried sea cucumbers, was found on the northwestern coast of Isla Fernandina, where the same procedure of confiscation and cleaning was carried out. On 6 March, at 15:30, during a voyage along the western coast of Isla Isabela, the launch *Guadalupe River* encountered the boat named *Magdalena*, with documentation number CN-02-0594, from Guayaquil. The boat was boarded by personnel from the Port Authority of Puerto Ayora, who found in the interior 25 sacks of dried sea cucumbers containing approximately 30,000 individuals. At present, this boat is detained by the Port Authority of Puerto Ayora, where it will receive the corresponding sanction. It is presumed that this is one of the boats that periodically makes clandestine trips between the continent and the Galapagos Islands to transport the illegally fished sea cucumbers.

It is worth mentioning that, since 1994, the exploitation of sea cucumbers in Galapagos has been prohibited, because this species is an integral part of the marine ecosystems and its exploitation could cause damage to the fragile insular biodiversity.

Edgar Vargas, translated by Gayle Davis-Merlen

PARK WARDEN WOUNDED BY BULLET IN CONFRONTATION BETWEEN ILLEGAL SEA CUCUMBER FISHERMEN AND PATROL PERSONNEL OF THE GALÁPAGOS NATIONAL PARK

Julio Lopez, crew member in the Galapagos National Park Service (GNPS), became the first victim in the fight against illegal fishing in the Archipelago. Julio was seri-

ously wounded in the abdomen by shots fired from an illegal camp of sea cucumber fishermen on western Isla Isabela.

The incident occurred on Wednesday, 19 March 1997, at approximately 3:00 in the afternoon (15:00), when a group of crew members and park wardens from the GNPS patrol boat *Belle Vie*, went to inspect an illegal camp detected during an aerial reconnaissance of the zone around Bahía Urvina, on the western coast of Isla Isabela. Upon attempting to disembark, the group was surprised by approximately 20 heavily armed men who were involved in processing sea cucumbers, which is prohibited by law, and who opened fire on the members of the Park Service, wounding one crew member in the abdomen. The wounded man was picked up by a helicopter belonging to a boat that was nearby and was taken to the hospital in the Second Naval Zone on Isla San Cristóbal.

Additionally, during the same aerial reconnaissance, various illegal camps of fishermen taking sea cucumbers and shark fins were detected, which prompted the dispatch of the GNPS patrol launch *Guadalupe River* to dismantle these camps. Once informed of the incident, the Second Naval Zone immediately dispatched a coast guard launch to help in the work of the Park's patrol boats.

The GNPS emphatically denounces this violent escalation against the actions to protect the resources of the Archipelago, and it announces that it will not tolerate any type of intimidation or aggression against its functionaries. Similarly, it makes an emphatic appeal to the National Government to offer the help necessary to protect the integrity of those who undertake the work of control and surveillance in the Archipelago.

Eliecer Cruz, translated by Gayle Davis-Merlen

PEACEFUL DEMONSTRATION TO REJECT VIOLENCE IN GALÁPAGOS

In rejection of the recent acts of vandalism that have occurred in the Archipelago, performed by a group of people dedicated to illegal fishing, the Galapagos National Park Service conducted a march to demonstrate solidarity with the park wardens who are in charge of controlling illegal fishing and, in particular, the park warden who was wounded by a gunshot during a recent patrol made to the western side of Isla Isabela.

More than 300 people joined the march, including representatives of the civilian society and of distinct unions and Galapagos institutions such as the Municipality of Santa Cruz, the Fishing Cooperative, I.E.S.S. (Ecuadorian Social Security Institution), Tourism Operators, the Charles Darwin Research Station, and Agriculture Department, among others.

For the Galápagos National Park, the support given by the entire Galápagos community through their participation in this demonstration is important. Of particular importance was the participation by the fishing cooperative, whose members expressed their backing of this institution and condemnation of the violent acts perpetrated by certain groups on Isla Isabela. They stated that those responsible do not belong to any of the three fishing cooperatives in the Archipelago. In addition, placards were carried during the march that expressed support for the injured park warden, Julio Lopez, and indicated that the entire community is concerned for the health of this galapagueño.

Park warden Julio Lopez has undergone two operations and he is on the road to a prompt recovery. He was transported and cared for in a clinic in Guayaquil and, after his complete recovery, will return to Galápagos to take up once again the work of protecting the insular ecosystems.

The Galápagos National Park Service, through its Office of the Director, has already initiated contact with the maximum governmental authorities in order to receive the protection necessary to continue the work of controlling the illegal fishery and to prevent, by this means, the occurrence of new acts of violence that endanger the lives of park wardens.

Elicer Cruz, translated by Gayle Davis-Merlen

CONFLICT IN THE GALÁPAGOS BIOLOGICAL RESERVE FOR MARINE RESOURCES, A STATEMENT BY THE PRESIDENT OF THE CHARLES DARWIN FOUNDATION

The Charles Darwin Foundation for the Galápagos Islands wishes to comment on the serious incidents that have taken place in the Biological Reserve of Marine Resources of Galápagos. The Galápagos National Park Service has issued several press bulletins in which these incidents have been reported. The incidents culminated in an armed attack on officials of the Galápagos National Park by illegal fishermen, resulting in one park warden seriously injured, as well as threats of retaliation against Park personnel for the capture of the boat *Magdalena*, which was transporting products from illegal fisheries.

The Charles Darwin Foundation supports the actions of the National Park Service and condemns the armed attack and the threats against that institution and its personnel. The Foundation calls upon the Ecuadorian Government to take a strong position in defense of the Biological Reserve of Marine Resources with regard to the types of fishing that are prohibited in the Reserve, above

all industrial fishing, fishing for sea cucumbers, and fishing for sharks.

The Charles Darwin Foundation also joins the Park in its position that the aggressive actions of this month have been provoked by a minority of citizens, who are dedicated to illegal fishing, many of whom have come to the Islands in recent years specifically to fish for sea cucumbers. The Foundation wishes to point out that it is aware that the great majority of the local fishermen and the population of Galápagos reject these violent actions and support the efforts of the National Park to conserve the Biological Reserve. The fishing cooperatives of Galápagos have often shown their respect and constant cooperation with the authorities of the National Park.

The Charles Darwin Foundation will not permit these problems to deflect it and its operative arm, the Charles Darwin Research Station, from positive actions to achieve better cooperation with the people of Galápagos on behalf of the conservation of the Islands.

The conservation of the ecosystem of Galápagos depends on the protection of the Biological Reserve of Marine Resources. In the face of serious threats from industrial fishing and fishing for sea cucumbers and sharks, it is indispensable that the Galápagos National Park be supported strongly by all authorities. The Charles Darwin Foundation requests urgent action to control the present situation, as well as long-term strengthening of the National Park, to guarantee the future of the Archipelago.

Jorge Anhalzer, translated by Gayle Davis-Merlen

REDISCOVERY OF AN "EXTINCT" ENDEMIC PLANT - THE FLOREANA FLAX *LINUM CRATERICOLA*

On 16 April 1997, two scientists from the Charles Darwin Research Station (CDRS) discovered a tiny population of the Floreana Flax *Linum cratericola*, after 16 years with no recorded observation of the species.

The plant was first discovered in two neighboring extinct volcanic craters on Floreana Island by the botanist Uno Eliasson, in December 1966. It was found again, in one of the same sites, in 1981. It has not been found anywhere else on Floreana, and there is no record of it on any other island in the Galápagos. Neither had it ever been seen since, despite repeated searches of the original localities and similar sites on Floreana, by botanists of the CDRS during the 1990s. Some considered that, given the effort that had been spent searching for it, the species must have gone extinct: the areas where it occurred have been badly damaged by introduced feral donkeys and goats, and one of the two known sites has been heavily invaded by the introduced pest bush "Curse of India" *Lantana camara*.

On the fifth search by CDRS botanists, and equipped with detailed notes supplied by Eliasson, the original sites of discovery were visited again by Alan Tye and Sarah Wilkinson. Even though both sites had been searched fruitlessly several times before, there was still the faint hope that the plant might survive.

In the first site described by Eliasson, where the species was still present in 1981, the crater rim was now found to be almost covered by a dense growth of *Lantana*, and in the few suitable remaining spots, no trace of the *Linum* was found. There was evidence there too of the presence of the introduced herbivores.

The team then visited the second crater, where Eliasson last saw the species in 1966, and searched the area described by him, as thoroughly as the difficult terrain permitted. As they were transiting in parallel along the crater wall, Alan Tye spotted a small, bright green plant that was immediately obvious as matching the specimens in the CDRS Herbarium. A closer examination of the area by the two researchers revealed thirteen plants of the Floreana Flax, only eight of them adult, in a tiny area of two square meters (18 square feet). Searches of similar habitat patches nearby revealed no additional plants.

The excitement of this discovery was tinged with worry. The plant, although not yet extinct, is obviously on the brink. The single site was by a pathway used by introduced animals, and the largest Flax plant was hidden within the stems of a bush, suggesting that the goats and donkeys eat the unprotected individuals. There are also *Lantana* bushes at the site, as well as other introduced plants. The two researchers left the crater, after making a thorough description, with the depressing thought that they could be the last people to see the species alive.

In conjunction with the Galápagos National Park Service, the CDRS is now formulating plans for the protection of this tiny population, and for its eventual reintroduction to other former sites. With rapid concerted action, the species might yet be saved.

Alan Tye

THE ARRIVAL OF MAREK'S DISEASE TO GALÁPAGOS

During the end of 1995 and the beginning of 1996 a breakout of an avian plague called Marek's Disease was reported for the first time in the Galápagos archipelago, specifically on Isla San Cristóbal. Immediate precautions were taken to diminish the dispersion of the sickness to other islands. Initially the precautions appeared successful and the disease was not reported anywhere else in the archipelago. Unfortunately, in October of 1996, the same disease was reported for the first time on Isla Santa Cruz. During October and November approximately 800 chickens from various farms died in the highland agriculture zone of Isla Santa Cruz.



Figure 1. Chicken with Marek's Disease. The right leg is paralyzed. Photograph by Heranán Vargas.

An analysis of two of the sick chickens collected from a farm in Bellavista and sent to Quito by the Dirección Provincial Agropecuaria (DPA) proved positive for Marek's Disease. The analysis was done by the Ecuadorian Animal Health Service (Servicio Ecuatoriano de Sanidad Animal - SESA). The analysis of the samples also indicated the presence of other diseases, *Salmonella pollorum*, *Mycoplasma gallisepticum* and parasites (ascarids and eggs of *Heterakis* [pinworms]). Of these diseases the most dangerous is Marek's, which has caused the loss of millions of dollars for the poultry industry worldwide.

Marek's Disease is caused by a herpes virus and is highly contagious and easily transmitted among chickens. The virus can live in the feathers of the fowl where it produces a type of feather dandruff that can disperse by wind and air currents. The disease is also spread by direct contact and through contaminated food.

Fowl which have contracted Marek's Disease will often demonstrate the following symptoms: paralysis of a foot or wing (Figure 1), poor vision to total blindness, enlarged feather follicles, and trembling. Sometimes these symptoms may not be obvious and affected birds may only show depression prior to death. Marek's Disease, as well as the other diseases registered, possibly arrived from

continental Ecuador on fighting cocks and/or eggs for incubation and human consumption.

Apparently a vaccine would not help in this case to control the spread of the disease because the vaccinated fowl still remains a carrier for the virus. The immune fowl could continue to pass the infectious virus on to other birds even though it would not suffer symptoms of the disease.

Because of the intensity of the outbreak on Isla Santa Cruz, the Charles Darwin Research Station (CDRS) has begun an investigation to determine the state of health of the native birds and the potential impact of introduced avian plagues. Preliminary observations indicate that two of the endemic species of ground finches (*Geospiza fortis* and *Geospiza fuliginosa*) are possibly the most susceptible to introduced avian diseases since they are the birds most often seen feeding alongside chickens and other introduced fowl. There has been one report by a farmer who observed some weak finches, but there has not been any positive evidence that the finches or other native birds have been fatally infected, although one rancher informed authorities of the death of four anis (*Crotophaga ani*), an introduced bird, in an area where there were diseased chickens, but the cause of death is uncertain.

The member institutions of the Quarantine Committee of Galápagos have taken various measures to prevent the dispersion of the disease to other islands such as Isla Isabela and Isla Floreana, where humans live and maintain populations of introduced fowl, but no sign of the disease has been reported. The Committee has made the following recommendations to avoid the further spread of the disease and possibly eradicate it where it exists:

1. Advise the ranchers of the quarantine methods. Quarantine Committee members have visited the farms and members of the DPA have remained in frequent contact with the farmers. It has been recommended to the farmers that once Marek's Disease is detected they should immediately sacrifice all the chickens, then burn or bury them and disinfect the area thoroughly.
2. Make the local community conscientious of the immediate necessity to implement a quarantine system in Galápagos. The CDRS, Servicio Parque Nacional Galápagos (SPNG) and the DPA have informed communities, by each of their respective radio programs, about the diseases which are being brought in and spread. It was also recommended that a video be made about Marek's Disease for community viewing.
3. Mandate ordinances associated with the quarantine. The Municipality of Santa Cruz is drawing up an ordinance to control and prohibit the keeping of domestic animals in the town of Puerto Ayora. This ordinance will permit the control of diseases by the eradication of chickens, fighting cocks, domestic pigeons, and other introduced animals which are a reservoir of diseases.

Unfortunately politics played a role contrary to conservation, and the largest flock of diseased chickens was never destroyed as recommended. This action demonstrates to us that much must be done to convince people about the mechanisms for disease control for the sake of economics and conservation.

The following is a summary of the avian diseases which have now been noted in Galápagos: Marek's, *Salmonella pollorum*, *Mycoplasma gallisepticum*, Newcastle's, Gumburo (or infectious bursal disease), infectious bronchitis, *Trichomonas gallinae* and avian pox. *T. gallinae* has been detected in native doves and the avian pox has affected various species of native terrestrial birds, most notably the endemic mockingbirds and Darwin's finches.

Avian diseases do not solely affect the economics of the farmers, but threaten the very biological diversity of the entire archipelago. We must join forces and implement a quarantine system for Galápagos and curtail these disastrous introductions.

Hernan Vargas and Heidi M. Snell

MORTALITY OF GIANT TORTOISES AT EL CHATO, ISLA SANTA CRUZ

The Government of Ecuador, through the Galápagos National Park Service (GNPS), in conjunction with the Charles Darwin Foundation (CDF), have undertaken research and management over the past thirty years to protect the giant tortoises of Galápagos. These efforts have been successful and, through the Program of Captive Rearing and Repatriation, have saved ten of the eleven threatened populations of giant tortoises; the exception is the race from Isla Pinta, from which the only remaining individual is the famous Lonesome George. Nevertheless, there are very serious new problems facing certain populations.

At the end of July and beginning of August 1996, reports were received of dead tortoises in the area of "El Chato," a visitor site in the Galápagos National Park (GNP) near the farms of Salasaca in the highlands of Isla Santa Cruz. Immediately, personnel of the GNPS, the Charles Darwin Research Station (CDRS), and the Provincial Agriculture Department (DPA) made trips to the site to perform an exhaustive search for dead or sick tortoises. During the first month of work, nine dead and eleven sick tortoises were found. Although individual dead tortoises have been observed over the years on all the islands, this is the first time that so many have been found in such a small area.

Unfortunately, nowhere in the world is there the necessary knowledge to resolve the problem within a short time. In general, there are very few studies on wild tortoises related to problems of health, nutrition, or of mortality due to unknown causes. The available information about the evaluation and diagnosis of reptile diseases is principally the result of work with animals in captivity.

To ensure that the efforts to study and manage the situation would be successful, immediate contact was made with two veterinarians in the United States who have considerable experience with tortoises and who have collaborated with the GNPS and the CDF in the past. Dr. Elliott Jacobson, of the University of Florida in Gainesville, is the world expert on tortoise diseases. Dr. Joseph Flanagan is the head veterinarian of the Houston Zoo in Texas.

A team was assembled to study and manage the problem *in situ*, directed by Dr. Linda Cayot, Head of Research for the Protection of Native Animals of the Charles Darwin Research Station (CDRS), Agronomist Sixto Naranjo, Head of Protection of the GNPS, and Dr. Edison Encalada, veterinarian. El Chato and adjacent areas were searched to determine the distribution of dead, ailing, and healthy tortoises. After an intensive search in various zones with different ecological conditions, dead and sick tortoises were found only in El Chato and further work focused on that area.

In El Chato, nine dead and eleven sick tortoises were found. During that period more than fifty healthy tortoises were also in the area. Samples were taken of blood and, whenever possible, of feces from sick and healthy tortoises from there and from tortoises found in other parts of Isla Santa Cruz. Necropsies were conducted on two dead tortoises and tissue samples were collected from all the principle organs. All the samples were sent to Dr. Jacobson for analysis in Florida.

Environmental conditions in the area are being studied. Samples were taken of the water in the main pond of El Chato. The results of toxicological analyses were negative; the results of bacteriological analyses indicated the presence of coliform bacteria, of anaerobic bacteria, and of fungus. Studies of the area and of tortoise feces indicated that the diet of the tortoises has changed. Some are feeding almost entirely on the fruit of an introduced plant "maracuya," a passionfruit (*Passiflora edulis*). An experiment is planned to study the effect of this change in diet.

To eliminate the possibility of transferring the problem to other areas, the GNPS closed the El Chato visitor site. As of 19 August 1996 only authorized personnel were allowed to enter the area. This was particularly important since the majority of visitors to that site are tourists who also visit the Rearing Center at the Darwin Research Station during the same day. A system of disinfection was established for those who enter the area with the aim of avoiding dispersal of a possible disease. Personnel who work in El Chato are different from those who work in the Rearing Center. Park wardens began a daily monitoring of the area to check on the sickest tortoises, to ensure that no unauthorized person entered the area, and to prevent the entrance of cattle or other animals from the nearby farms.

Based on the condition of the tortoises and the environment of El Chato, a list has been drawn up of factors that could be part of the problem. The cause of death could

be a combination of several factors; the exact identification of the cause of death may be impossible. Potential factors in the poor condition of the tortoises include:

- Unbalanced nutrition related to the high consumption of passionfruit.
- Poisoning by passionfruit.
- Poisoning by herbicides, pesticides, or fertilizers.
- Abnormal increase in the quantity of intestinal parasites.
- Unknown bacterial or viral disease.
- Infection of the pond in El Chato due to the death of a tortoise within it.

To date, the preliminary analyses do not allow us to determine the cause of death.

Due to the ever-accelerating increase in changes in the insular ecosystems of Galápagos and the potential impact of these changes on the native fauna, it is imperative to initiate a system to monitor the health status of various species. The lack of basic information acts as a barrier to action when these types of problems arise. It is suggested that a system be established first with the tortoises, then be extended to other reptiles and to birds. The outbreak of Marek's disease in the chickens of Isla San Cristóbal in 1995 shows that, without a good quarantine system, new diseases will arrive with potentially severe impacts on these vulnerable ecosystems. The continued loss of integrity in these ecosystems, especially on populated islands, can affect the health of all native species and makes them even more vulnerable to diseases and changes in diet and habitat.

The fact that mortality of tortoises has not been recorded on this level in the past suggests that the mortality detected may be related to changes in the integrity of the ecosystems. The future protection of the Galápagos flora and fauna depends not only on efforts of research and management, but also on the establishment, continued operation, and maintenance of an effective quarantine system.

Linda J. Cayot and Eliecer Cruz

THE DARWIN STATION BEGINS A MONTHLY PROGRAM ON LOCAL TELEVISION

Part of the objectives of the Communication and Education Department of the CDRS is to spread information about activities at the Station to the local community. This includes information about internal Station programs, projects by visiting scientists, as well as activities which are shared by the Station and other institutions. In Galápagos, there is an ever-increasing audience which is in need of information about where they live and the activities of local organizations. The Communication and

Education Department is presently including local mass-media in its strategy to communicate more effectively to the residents of the islands.

Within this parameter, a decision was made to produce a monthly television program. Before the first program could be completed however, an audiovisual production studio had to be finished and the existing personnel in the Department had to be reorganized for working in this new area. After the formation of the working group and the establishment of information objectives for television media, the first program of "A Mil Kilometers" (At a Thousand Kilometers) was aired in March of 1997. The Station's new local television program has a pleasant and personal format whose objectives are to entertain and inform the local populace about the continuous activities of the CDRS.

Rita Spadafora, translated by H. M. Snell

ACCOUNT OF A HISTORICAL CROSSING OF ISTHMUS PERRY

This letter was submitted by Galápagos Naturalist Guide Cynthia Manning for people who have an interest in past historical events and to bring to light a letter she was given by a fellow guide, Henk Kastelen. The letter was written by David M. Payne who revisited the islands in 1985 on the *M/V Santa Cruz* after serving in the military in the Galápagos during 1942. He wrote the following about a memorable crossing of the Isthmus Perry with several other adventurous crewmen. The following is an extract from that letter:

At the time I was a Naval Reserve Officer, captain of one of the PT boats of Motor Torpedo Squadron 5. In November 1942, six of our boats went to the Galápagos from Panama, our purpose being to patrol the islands against a possible attack on the airfield being constructed on Seymour Island and to search the islands for traces of enemy occupation.

On a sunny day my boat and another were cruising down the coast of Albermarle. We anchored in a strong onshore wind in the bight to the east of Perry Isthmus. Someone (it may have been me), had the idea that it would be profitable or at least gratifying if a shore party were to cross the isthmus on foot, while the boats went around to the other side to pick the party up. On our ancient and inadequate map, the distance across looked negligible, perhaps three or four miles, and with their high speed the boats could easily round the island in a few hours. So a half a dozen of us were put ashore, rather ill-equipped. We had no idea what we were getting into.

At first the going was good, part lava and still the breeze, and no trouble finding our way towards the

saddle of the isthmus, although occasionally we would go up a deep dead-end gully. The going deteriorated. The lava was sheeted, thin sheets like giant crisp oatmeal cookies. A foot placed for an ordinary step might crash through the sheet, with one, two, or ten feet of emptiness below. There were many scarred legs, trousers in shreds and luckily no broken bones. It was the worst going I have ever known or imagined, and I doubt if our forward progress was anything like half-a-mile an hour. By this time the lava felt as hot to touch as a pot on a stove, and I suppose the air temperature (mid-afternoon) at ground level was 130 degrees F, perhaps more. Thirst was passing the point of irritation and becoming serious. We got late in the day to a series of lava ridges rising to the crest; each ridge was sure to be the top of the saddle, but never was. When night came we built a small fire of deadwood; we could not go on in the dark in that terrain. Our canteens were now empty, in spite of careful husbanding; a couple cans of tomatoes I had luckily brought were like elixir. One gulp per person was it.

In the morning on we went, more ridges and heat. By mid-day we were so feeble and dehydrated that our rate of progress was extremely slow and halting and our tongues and lips were swollen and black. We had been holding pebbles in our mouths, and we had tried chewing and sucking the fleshy part of cacti, with indifferent results. My last few drops of urine were like ink. Eventually the sea appeared. The boats had assumed we had turned back and were gone, but at least the trip was over. All of us plodded straight into the sea, and I shall never forget the wonderful coolness. We stayed submerged for some time, soaking and washing our mouths out. I believe some of the party actually drank sea-water (which seemed relatively non-saline) and suffered no ill-effects. We were all wearing comparatively new Marine combat boots, with thick composition soles, and in some cases the soles were completely worn through, with nothing left but the ragged uppers. Soon after dark one of the boats returned on the chance we had not turned back. We were ferried aboard on the dinghy, I can remember the infinite luxury of lying on a mattress and drinking can after can of grapefruit concentrate.

We all recovered very quickly but I wouldn't want to try it again unless the water supply was pretty well organized.

As far as we know, Isthmus Perry has been crossed at least two subsequent times. Roger Perry and Rolf Seivers crossed while Roger was the Director of the CDRS and Hendrik Hoeck and Howard Snell crossed in 1978. All of these individuals recall that there are nicer places to wander about!

Cynthia Manning and Heidi M. Snell