A large deep freshwater lake beneath the ice of central East Antarctica

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IN 1974–75, an airborne radio-echo survey of ice depths over central East Antarctica led to the discovery of a sub-ice lake of unknown depth and composition, with an area of about 10,000km^2 and lying beneath 4km of ice[1]. In 1993, altimetric data from satellite measurements[2] provided independent evidence of the lake's areal extent, thus confirming it to be the largest known sub-ice lake by an order of magnitude. Here we analyse new altimetric and radio-echo data, along with existing seismic data[3], to show that the lake is deep (mean depth of 125 m or more) and fresh, and that it has an area that exceeds previous estimates by about 50%—dimensions comparable with those of Lake Ontario. We estimate that the residence time of the water in the lake is of the order of tens of thousands of years, and that the mean age of water in the lake, since deposition as surface ice, is about one million years. Regional ice-dynamics can be explained in terms of steady-state ice flow along and over the lake.

NAT GEO mags Sound of Humpback Whales ;; should be in iTunes
Migration:

KEY: food & safe breeding
How routes established?:
N (Arctic)summer safe breeding cuz few large redators can survive the prior winter, food cuz longer days/more food (24 hr day) lightlarger land masses > S (Antarctica) to winter (warmer)
Some the reverse (?, perhaps less competition
Inland > castal
Lower elevations to higher

How?
- Wind “conveyor belts”, winds may flow different directions at different altitudes, hi alt. = stronger winds
- Large birds use rising morning thermals & along ridges & coast downhill to next thermal
- Some non-stop for several days, most use staging stops to replenish fats
- Moult immediately proor to migration so ‘best, new” feathers

Navigation:
- Sun- day; stars – night
- Magnetic N (what about pole shifts and mag pole shifts effect of finding precise site) *
- Other: land visuals (mts, lakes etc); smell; sound (waves, falls, mt pass winds,)
- All hard wired into brains, but * Note: young abandoned after fledging & navigate themselves

Polynya

A polynya **(common US spelling) or** polynia **(common UK spelling) (pronounced /pəˈlɪnjə/) is an area of open water surrounded by sea ice.[1] It is now used as geographical term for areas of sea in Arctic or Antarctic regions which remain unfrozen for much of the year. It is a loanword from Russian: полынья, Russian pronunciation: [pəlʲɪˈnʲja] (polynya or polynia), which means a natural ice hole, and was adopted in the 19th century by polar explorers to describe navigable portions of the sea.[2][3] In past decades, for example, some polynyas, such as the Weddell Polynya, have lasted over multiple winters (1974–1976)**

Bird Migration:

An Arctic Tern can live for 25 years. Over its lifetime, it can fly a million kilometers – nearly three times the distance from the Earth to the moon.

It breeds on the shores of the Arctic Ocean in northern hemisphere summer. And it feeds over the oceans of the southern hemisphere half a year later – in southern hemisphere summer. So, like many birds, this bird flies great distances every year to maintain its life of endless summertime.

North American Arctic Terns fly about 40,000 kilometers – or 24,000 miles – each year. That’s a distance about equal to the distance around the Earth.

An Arctic Tern can live for 25 years, so in its life-long quest for summer it can fly a million kilometers – nearly three times the distance from the Earth to the moon.

A Wandering Albatross might fly 30,000 kilometers – that's 18,000 miles – between breedings.
Other birds stay in one hemisphere, but go farther. For example, the Wandering Albatross spends most of its life aloft, circling the world over the oceans of the southern hemisphere. It stops only to breed on storm-swept islands near Antarctica.

Seals swallow rocks. Why???

Waring said he's never heard of that, but it is not uncommon to find harp seals that have swallowed rocks.

He said some speculate they swallow rocks to regulate buoyancy, or because they are starving.

Thurman wonders if it may be because the animals -- which in their normal range lick ice to get drinking water -- mistake the rocks as a water source.

Krill

is the common name given to the order Euphausiacea of shrimp-like marine crustaceans. Also known as euphausiids, these small invertebrates are found in all oceans of the world. The common name *krill* comes from the Norwegian word *krill* meaning "young fry of fish",[1] which is also often attributed to other species of fish.
Krill are considered an important trophic connection—near the bottom of the food chain—because they feed on phytoplankton and to a lesser extent zooplankton, converting these into a form suitable for many larger animals for whom krill makes up the largest part of their diet. In the Southern Ocean, one species, the Antarctic krill, *Euphausia superba*, makes up an estimated biomass of over 500,000,000 tonnes (490,000,000 LT; 550,000,000 ST), roughly twice that of humans. Of this, over half is eaten by whales, seals, penguins, squid and fish each year, and is replaced by growth and reproduction. Most krill species display large daily vertical migrations, thus providing food for predators near the surface at night and in deeper waters during the day.
Commercial fishing of krill is done in the Southern Ocean and in the waters around Japan. The total global harvest amounts to 150,000–200,000 tonnes (150,000–200,000 LT; 170,000–220,000 ST) annually, most of this from the Scotia Sea. Most of the krill catch is used for aquaculture and aquarium feeds, as bait in sport fishing, or in the pharmaceutical industry. In Japan and Russia, krill is also used for human consumption and is known as *okiami* (オキアミ?)[1] in Japan.

dating of the speciation events have been estimated by means of molecular clock methods, which place the last common ancestor of the krill family Euphausiidae (order Euphausiacea minus *Bentheuphausia amblyops*) to have lived in the Lower Cretaceous about 130 million years ag

the six *Euphausia* species native to the Southern Ocean.
In the Antarctic, seven species are known,[23] one species of the genus *Thysanoessa* (*T. macrura*) and six of the genus *Euphausia*. The Antarctic krill (*Euphausia superba*) commonly lives at depths of as much as 100 m (330 ft),[24] whereas ice krill (*Euphausia crystallorophias*) have been recorded at a depth of 4,000 m (13,100 ft), though they commonly live at depths of at most 300–600 m (1,000–2,000 ft).[25] Both are found at latitudes south of 55° S, with *E. crystallorophias* dominating south of 74° S[26] and in regions of pack ice. Other species known in the Southern Ocean are *E. frigida*, *E. longirostris*, *E. triacantha* and *E. vallentini*.[27]

Most krill are swarming animals; the sizes and densities of such swarms vary greatly depending on the species and the region. For *Euphausia superba*, there have been reports of swarms of up to 10,000 to 60,000 individuals per cubic metre.[38][39] Swarming is a defensive mechanism, confusing smaller predators that would like to pick out single individuals. Krill typically follow a diurnal vertical migration. Until recently it has been assumed that they spend the day at greater depths and rise during the night toward the surface. It has been found that the deeper they go, the more they reduce their activity,[40] apparently to reduce encounters with predators and to conserve energy. Later work suggested that swimming activity in krill varied with stomach fullness. Satiated animals that had been feeding at the surface swim less actively and therefor sink below the mixed layer.[41] As they sink they produce faeces which may mean that they have an important role to play in the Antarctic carbon cycle. Krill with empty stomachs were found to swim more actively and thus head towards the surface. This implies that vertical migration may be a bi or tri daily occurrence. Some species (e.g., *Euphausia superba*, *E. pacifica*, *E. hanseni*, *Pseudeuphausia latifrons*, and *Thysanoessa spinifera*) also form surface swarms during the day for feeding and reproductive purposes even though such behaviour is dangerous because it makes them extremely vulnerable to predators.[42]

Beating pleopods of a swimming Antarctic krill

Dense swarms may elicit a feeding frenzy among fish, birds and mammal predators, especially near the surface. When disturbed, a swarm scatters, and some individuals have even been observed to moult instantaneously, leaving the exuvia behind as a decoy.
Krill are an important element of the food chain. Antarctic krill feed directly on phytoplankton, converting the primary production energy into a form suitable for consumption by larger animals that cannot feed directly on the minuscule algae. Some species like the Northern krill have a relatively small filtering basket and actively hunt for copepods and larger zooplankton.[32] Many animals feed on krill, ranging from smaller animals like fish or penguins to larger ones like seals and even baleen whales.[46]

Disturbances of an ecosystem resulting in a decline in the krill population can have far-reaching effects. During a coccolithophore bloom in the Bering Sea in 1998,[47] for instance, the diatom concentration dropped in the affected area. Krill cannot feed on the smaller coccolithophores, and consequently the krill population (mainly *E. pacifica*) in that region declined sharply. This in turn affected other species: the shearwater population dropped, and the incident was even thought to have been a reason for salmon not returning to the rivers of western Alaska that season.[48]

Other factors besides predation and food availability can influence the mortality rate in krill populations. As temperatures have risen over the past couple decades, Antarctic sea ice has melted. In this way, climate change poses a threat to krill populations as they feed on algae beneath the ice.[49]

the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) defined maximum catch quotas for a sustainable exploitation of Antarctic krill. The annual catch in Antarctic waters seems to have stabilised around 100,000 tonnes of krill, which is roughly one fiftieth of the CCAMLR catch quota.[62] The main limiting factor is probably the high cost associated with Antarctic operations, although there are some political and legal issues as well.[63

TO DO

Documents:

Passport Belt:

- Passport , SS, Plan F card
- Bumped summary
- 2 Photos
- Travelex Confirmation of Coverage & support docs
- Lost Luggage

DAYpack:

- **Yakush hostel**
- Ushuaia map
- ! ANT ITIN 2011
- ANT Travel Notes
- Air Ticket SUM: TUS> DFW>BA>CUSH
- Lost Luggage Report
- Quark DOC
  - Expedition CONFIRMation
  - Quark EXPED INVOICE

Suitcase:

- Bottom Compartment VISIBLE drug list
- ANT MST Travel PAK
  - Amer A TIK SUM: TUS>DFW>BA
  - AeroA TIK SUMN: EZE>USH
  - ! ANT ITIN 2011
  - ANT Travel Notes
  - Passport
  - Travelex Confirmation of Coverage & support docs
  - Bumped summary/Steripen
  - Lost Luggage Report
  - Drug List
  - Full Travel INV
  - Sandy's RV
- LP DOCs:
  - Ushuai sites & hostesl & food
  - NP Terra del Fuego MAP
  - NP Terra del Fuego
  - Estancia Harberton
  - Tierra del Fuego map
  - Ushuaia map
- Quark DOCs
  - Expedition CONFIRMation
  - Quark EXPED INVOICE
  - Guides (4 pages
  - Peninsula Maps
    - Q ITIN Map
    - ANT Peninsula maps (2)

Q Readin List

List of Key ANT explorers

BA & Ushuaia: AA & Aero Arg.:

Amer Air eTicket Number: 001-7873858033 800-433-7300
Airline record locator: **Amer. Air**: NZFACG
Exito record locator: 2UXM4Z
Aero Arg eTicket Number: 044-7873638621 970-482-3019
Airline record locator: **Aero Arg**: EOHKXU
Exito record locator: Z25ZHU

DO NOT check baggage thru to Ushaia

Exiito: Ken Jonson: 800-655-4054 X8531

SERVICE	DATE	FROM	TO	DEPART	ARRIVE	DURATION
AA 1288	**22Feb TUE**	**TUS**	**> DFW > Term: ?**	**2:40pm**	**5:50pm (1440)**	**2h 10m (1750) Seat: 18E**
	Time between flights: 2hr 5m					
AA 997	**22Feb TUE**	**DFW Term: D**	**> EZE > Term: M**	**7:35pm (1935)**	**8:55am(+1D) (0855)**	**10h 20m Seat: 43F**
	Time between flights: 1hr 35m					
AeArg 2856	**23Feb WED**	**AEP Term: 1**	**> USH > Term: 3**	**3:55pm (1555)**	**7:30pm (1930 ARV)**	**3h 35m**
$2009.47	**ARV: 1-25**	**TOT DUR: 19h 35m**				**Seat: 18Aw**
						Change at counter

Phone card: 800-569-6972; 2712-9406-3927

TRANS: INTN'L: AIR: TUS > EZE (Ezeiza) > AEP(Newberry) > USH

Shuttle: Ezeiza Intl(EZE) > Aeropuerto(AEP): Manual Tienda Leon's $15 shuttle immediately outside customs

Money Conversion: > Banco de la Nacion Small office, past all the cambios & transport booths **$1USD = 4.017ARS**

Tourist Info Booth: beyond city taxi stand

Ushuaia P518 NITES (days, travel)

TO-FROM Airport:

Quark PEEPS: GET INFO

ACCM:

Yakush 2/ 23, 24, 25
Hausch (Old Cruz)
Freestyle

FOOD: LP526

SITES:

Rumbo Sur: informes@rumbosur.com.ar Lorena, Marial Ferrero
Parque Yatana L521
Historical Houses: LP521: tourist OFF : free guide
Estancia Harberton LP530 **See separate page**

TO DO:

PN Tierra del Fuego (park)

DIRECS: BUS >: 9am, RETURN: hourly 8pm; Ushuaia map: 66C3,
S. Fuegian RR: tour Pipo River valley: Susanna Mount ; prisoner of the old prison

DONE:

PN Tierra del Fuego
Cerro Martyial y Glaciar Martial p447

City Tour:
- City Tour: chairlift, old prison; Maritime MUS, End of World
- Maipu Av Footbridge Luis Pedro Fique (cross) > La Mission area > Brown & Solier
- Chairlift Le Martial Glaciar
- NP Tierra del Fuego: Take Southem Fuegian RR
  - Lakes, lagoons, En route: old prison. Roco Lake hike;rn & Blk lagoons; beaver dams
- NP Pipo Rio;
- Maritime Museum
- Old Prison of Ushuaia

Museo Maritimo y Museo Del Presidio p447
Mundo Yamana museo p447
Museo del Fin del Mundo p447

Quark Expeditions:

Quark PRE Boarding TO DO: PRINT THIS

Mark each piece of Baggage with his full name and address, name of Vessel, cabin number and destination.
Arrive at least two (2) hours before scheduled sailing.
Have: Ticket;, valid passport & visas;
Cara X220 800-356-5699 / 203-852-5580; email@quarkexpeditions.com

"Crossing the Circle: Southern Expedition": 15 D
Booking #: 32978 2/26 – 3/12/2011
Username: scott#51020 PW: 51020IO Doesn't work
Akademik Ioffe Cabin 306:
Hotel Albatros: 1st Nite 2-26, GOTO ship : 2-27 Quark rep on 26th

2/26: 15 day 3 D RM 6490 – 1500 – 500 = $4490
Boat: Akademik sergy Vavilov

Ushuais CONTACT:

USHUAIA GROUND AGENT: Rumbo Sur, S. R. L. San Martin 350 9410 Ushuaia, Argentina Contact: **Carina Maslam** TEL: (54 2901) 421 139 / 422 441 __ Ext 122 E--mail: carinam@rumbosur.com.ar

QUARK EXPEDITIONS - USHUAIA: c/o Navalia SRL 25 De Mayo 250 9410 Ushuaia, Argentina Contact: **Marcelo Vanecek** TEL: (54 2901) 424 403 TEL: (54 9 2901) 61 6616 (Cell) E--mail: marcelo.vanecek@quarkexpeditions.com

HOTEL ALBATROS: Av. Maipu, 505 9410 Ushuaia, Argentina TEL: (54--2901) 437--300 TEL: (in Ushuaia) 437--300 E--mail: reservas@albatroshotel.com.ar

CAI > Tucson: FRI 11-Mar, 2011 DP: 9:45am

Amer Air eTicket Number: 001-7873858033 800-433-7300
Airline record locator: **Amer. Air**: NZFACG
Exito record locator: 2UXM4Z (www.checkmytrip.com)

Aero Arg eTicket Number: 044-7873638621
Airline record locator: **Aero Arg**: EOHKXU
Exito record locator: Z25ZHU (www.checkmytrip.com)

AA & Aero Arg.:

SERVICE	DATE	FROM	TO	DEPART	ARRIVE	DURATION
AeArg 2892	15Mar TUE	USH Term	> EZE > Term: 3	2:28pm (1428)	5:48pm (1748)	3h 20m
					Seat: 31Ew	
	Time between flights:			1h 10m		
AA 996	15Mar TUE	EZE Term: 3	> DFW > Term: D	9:25pm (2125)	6:20am(+1D) (0620)	10h 55m
					Seat: 36G	
	Time between flights:			2hr 25m		
AA 1841	16Mar WED	DFW Term: 3	> TUS > Term:--	9:45am (0945)	10:10am (1010ARV)	2h 25m
		TOT DUR: 21h 15m			Seat: 30F	

HIKES near Ushuaia:: **PN Tierra del Fuego**

SENDA COSTERA:

At the end of road that leads cars to bahía Ensenada, find footpath westwards along the shore of the Beagle channel allowing you to see a combination of forest and sea coasts. Unique place to watch marine and coastal avifauna, also different kinds of trees and bushes, most of them bloom in summertime. These shores were the home of Yamana natives which become obvious for the profuse remains of shells and ash monticules which are covered now by herbal vegetation (Indian middens).
At last the track goes back towards where it ends. This walk takes about three hours. It can also be done the other way round. Degree of difficulty: Medium - Length: 8 km.

XXIV BOUNDARY:

8km from park entrance > Lago Roca parking lot this footpath starts. Going along the coast on the northern side of the lake it goes as far as Hito XXIV, which is the actual boundary between Argentina and Chile. It takes three hours forth and back, in the meantime you can enjoy ravishing view of Piramide chain and lake Roca while walking among high deciduous beech forests that cover the Guanaco chain, which can be seen on the right-hand side. Degree of difficulty: Soft - Length: 5 km (low).

PASEO DE LA ISLA:

This path begins after crossing over the bridge on Lapataia river, opposite the National Park Gendarmery Station and takes you to a section of the Cormoranes archipelago. You can enjoy a beautiful view with little effort. There is also the possibility of watching forests and coastal birds. Degree of difficulty: Soft - Length: 1,5 km.

LAGUNA NEGRA:

This is the round footpath that begins after crossing over the Ovando river bridge, on the right hand side. It is the best way to observe a peat-bog formation.
Degree of difficulty: Soft - Length: 1 km. (the whole circuit).

LAS LENGAS:

It is located after crossing the bridge over the Ovando river on the left-hand side. This path includes two different tours: Lookout track presenting a panoramic view of Lapataia bay and the possibility of later going down towards it and peat-bog track climbing fuegian forest, peat-bogs and abandoned beavers'dams.
Degree of difficulty: Soft - Length: 2 km (low)

CASTORERA:

Starts at the end the N° 3 national road and as it goes into the forest many beavers'dams can be seen. It can be done in combination with peat-bog track (Circuito Las Lengas). Degree of difficulty: Soft - Length: 200 m (low)

PAMPA ALTA:

The climbing path to Pampa Alta hill begins in N°3 National road, about 3 km away from the park's entrance gate. Half way of the track an active beavers 'dam can be seen as you get to the top. You enjoy a beautiful panoramic view of the western part of the Beagle channel including Redonda Island and Chilean Island Navarino and Hoste. To the northwest you will see the outstanding Guanaco Hill. Afterwards you can walk down towards Cañadon del Toro or return by previous path. This hill is about 300 high and it takes about one hour to get the top.
The other possibility is finding this track as of the path that leads you towards Cañadon del Toro. Degree of difficulty: Medium - Length: 5 km (going down Cañadon del Toro).

***CERRO GUANACO**:*

This track starts in the same place as the one that takes you to Hito XXIV, but goes fast upwards to the right after crossing the first stream. It takes about four hours to get to the top of the mountain, which is 970 m high above sea level, from up there you have a wonderful view of the Beagle channel, Cañadon del Toro and Chilean Islands Navarino and Hoste. Another option, after only two and a half hours walking you can get to a lookout from which lago Roca is seen and also the southern area of the park. Degree of difficulty: Demanding - Length: 8 km (low).

Estancia Harberton **LP530** See separate page

DIRECS: DP early: **1 1/2hr,** Combi **(**minibus: Shuttle @ base of 25 de Mayo& Av Maipu @ 9am, return 3pm - AR150**), 85 mi E on Nat Rt 3 > unpaved Ruta 33 (Provincial RT 3) , :**

DRIVE SITES, ETC.: Much road follows Río Lasifashaj through Valle Tierra Mayor, past winter sports centers ; THEN long valley behind the coastal range > Beagle Channel at Bahía Almirante Brown. Puerto Williams, Isla Navarino across bay. **Landscapes**: mtn. ranges, dense *Nothofagus* forests, *Sphagnum* peat-bog valleys and ; along coast, strong W-SW winds form "flag trees". **Unique geology**: low, NW>SE facing drumlins, Beaver dams.

www.estanciaharberton.com, www.acatushun.org e-mail: estanciaharberton@gmail.com.

Walking Tour: 11am,1:30pm, 3pm & 5pm**; Botanical Garden, Yamana huts replicas**

MUS: RES ??? (1+ hr, 10am>7pm) Museo Acatushún de Aves y Mamíferos Marinos Australes ($20) work lab, EXHIBT Hall: underwater simulation, Bone House,

Lunch (Casa de Té Mánacatush**,) ;**

Penquin Island (Seems redundant to Quark)

HISTORY: Estancia Harberton (1886), oldest estancia (farm) in Tierra del Fuego , missionary pioneer Thomas Bridges (1842-1898) an orphan found on a bridge somewhere in England and later adopted by an Anglican missionary, the Rev. G.P. Despard. In 1856, at the age of 13, he was taken with his adoptive family to Keppel (Vigía) Island in the Falkland (Malvinas) Islands, where an agricultural mission station was being established. There he learned Yahgan, the language of the Yámana canoe people from TF, who were taken there for training. By his first trip to Tierra del Fuego, in 1863, he was able to speak with the Fuegians and explain what the Mission wanted to do. He founded the Anglican Mission at Ushuaia in 1870, establishing there permanently with his wife, Mary Ann Varder, and their small daughter Mary, in 1871.; resigned from the Anglican mission at Ushuaia; named for Harberton, Devon, home of his wife, Mary Ann Varder (1842-1922). Bridges was author of a dictionary of the Yamana or Yaghan language, and their son Lucas Bridges (1874-1949) would write ***The Uttermost Part of the Earth*** about his boyhood, the Yamana, and the family's adventures in getting the dictionary published in Europe.[1]

Present manager & part-owner, Tommy Goodall (born 1933), is Thomas Bridges's great-grandson, who still manages estancia w/ his wife, American biologist Rae Natalie Prosser, with help from their daughter & her children. (Though Bridges name has been daughtered out, there is a Thomas in every generation.)

History of Harberton

In 1884, he received the first Argentine expedition to Tierra del Fuego, which set up the subprefecture at Ushuaia. Two years later, after thirty years with Keppel and Ushuaia missions, Bridges received Argentine citizenship and a donation of land from Argentine National Congress under Julio A. Roca in acknowledgement for his work with natives and with shipwrecked sailors of the Cape Horn area. **LOCATION**: The estancia he founded, at first called Downeast, is located 40 nautical miles (60 km) east of Ushuaia. It was named Harberton after his wife's birthplace in Devon, England and was 1st productive biz in Tierra del Fuego (earlier enterprises, such as sealing, whaling and gold digging, were all exploitive). **NOW** belongs to grandchildren of Thomas Bridges' sons Will and Lucas. Its manager, Thomas D. Goodall, is a fourth generation great-grandson of the founder, and lives at estancia in original 1887 house with his family, members of 5t & 6th generations.
Declared an Argentine National Historical Monument in 1999, the estancia maintains its original simple buildings of wood covered with corrugated iron, its gardens, stone piers, and terraces. Originally operating with sheep (for wool), cattle (for meat), Harberton also had the first *almacén* (store) and imported supplies for all of southern TF, as well as selling vegetables, meat and supplies to the gold miners of the era.
There are many books and articles about the Bridges family and TF, but the undeniable classic remains *Uttermost Part of the Earth*, by E. Lucas Bridges, son of the founder. One of the world's great adventure stories, it was chosen by the New York Explorer's Club as one of the 100 best first-person exploration narratives of the 20th century.
As an estancia, the sheep were gradually discontinued after 1995 as uneconomical. The estancia now has only cattle and is open to the public from October 15th to April 15th, except on Christmas, New Year and Easter.

Boat excursions: 4 hr: LP521: sea lions, cormorants, Highlight: island stop

ALSO: take to NP Teirra del Fuego
BEST: Tres Marias Excursiones