

VASCULAR PLANTS ON THE ISLANDS AND PENINSULAS OF MALOE MORE (LAKE BAIKAL): PATTERNS OF DIVERSITY AND SPECIES TURNOVER

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LAKE BAIKAL: BACKGROUND

- 25 million years old
- Oldest and deepest fresh water lake in the world.
- Formed in the Paleozoic, Mesozoic and Cenezoic periods.
- Contains 20% of the worlds unfrozen water supply.



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BACKGROUND: *CONTINUED*

- One of the most bio diverse lakes on Earth
- 1,340 species of animal (745 endemic)
- 570 species of plant (150 endemic).
- Surrounding the lake there are 10 threatened species and typical boreal species.
- Home to a unique species of freshwater earless seals called the nerpa



LOCATION OF LAKE BAIKAL

Lake Baikal is located in the northern caucuses. It is situated inside of Siberia north of Mongolia and west of China. It belongs to the Irkutsk Oblast of Russia. Maloe More is about 70 km in length and covers about 640,000 km between the mainland and Olkhon Island.

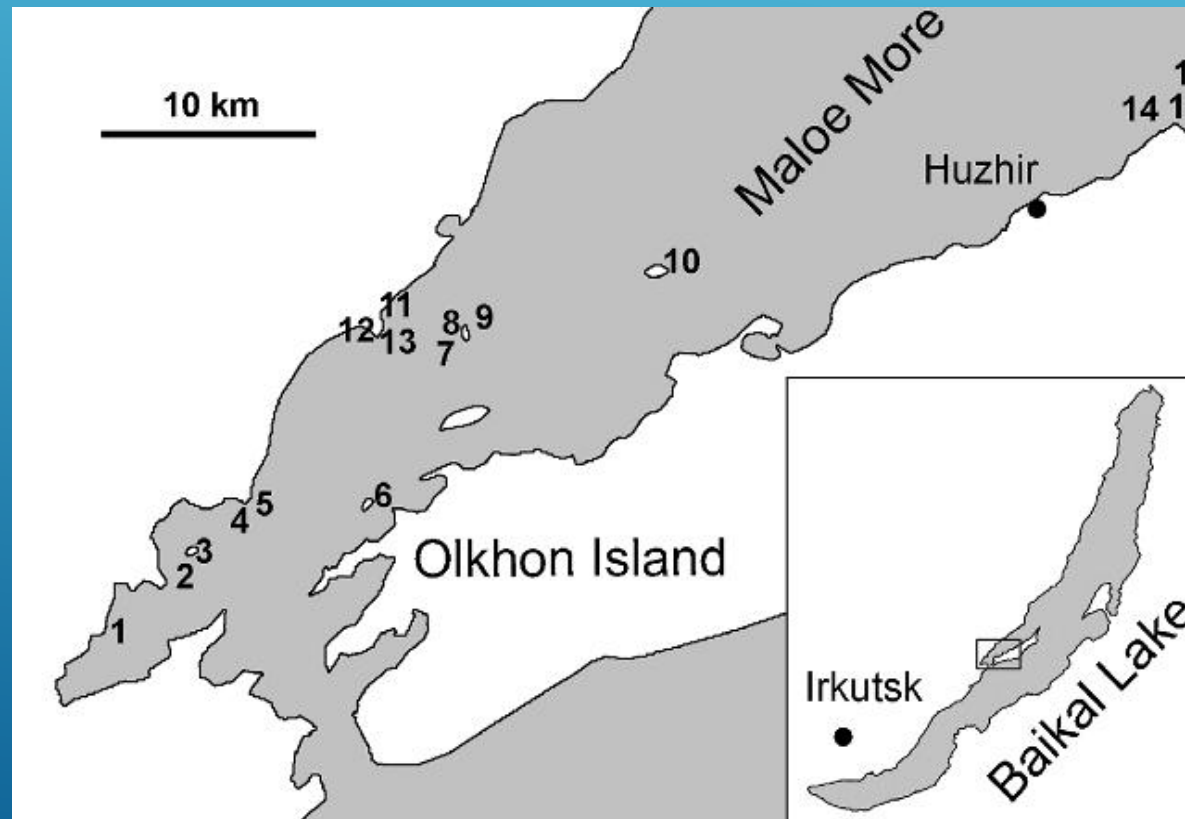
PRIMARY GOALS OF STUDY

- ▶ Document spatial patterns in diversity of vascular plants
- ▶ Explore effects of natural(bird colonies) and human-induced (tourism) disturbances.
- ▶ Explore these effects on 12 islands and 4 peninsulas
- ▶ Estimate species turnover on a subset of 5 islands within a 30 year period.
- ▶ Use results to asses conservation value of Maloe More islands and develop recommendations for protection of regional biodiversity

THREATS TO BIO DIVERSITY

- ▶ 1. Pollution is seen as the largest threat to biodiversity. The most acute problem is associated with the paper and pulp mill in Baikalsk.
- ▶ 2. Contamination coming from the Selenga river which flows into Baikal is another source of pollution.
- ▶ 3. Increasing tourism poses terrestrial and aquatic pressures on the ecosystem.
- ▶ Currently tourism is disorganized and uncontrolled. This is disturbing and damaging important natural areas.


MAP OF STUDY AREA




STUDY AREA

- ▶ Semi-desert and Steppe-desert
- ▶ Arid climate
- ▶ Annual precipitation is 230mm or less
- ▶ Annual temperature is -1.2 degrees Celsius
- ▶ Frost free period lasts 110-127 days
- ▶ Small islands are exposed to strong winds up to 40 ms⁻¹
- ▶ Islands are treeless with the exception of Zamogoj

PLANT SAMPLING

- ▶ Surveys were conducted simultaneously by all 4 people in the group
 - ▶ On small islands and peninsulas sampling was discontinued individually when no new species had been recorded for 5 min.
 - ▶ Fixed times were used on the largest islands due to time constraints. (Khubyn, Oltrek and Zamogoj)
 - ▶ 1 person (the VCC) recorded common species using pre printed forms and collected only specimens that needed to be identified in a lab.
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- Several white lines of varying lengths and orientations are positioned on the right side of the slide, extending from the middle to the bottom right corner.

PLANT SAMPLING: *CONTINUED*

- ▶ The other 3 people sampled above ground plants seen along the way and these samples were identified on the day of collection by the VCC
 - ▶ Each collector recorded species separately
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COLLECTION OF ADDITIONAL INFORMATION

Tourism/Recreational Activities

- ▶ 0= no visible traces of visitation
- ▶ 1= rubbish or other signs of visitation were occasionally seen
- ▶ 2= trampled vegetation, paths, scrap-heaps and bonfire places were frequent across the island/peninsula

Bird Colonies

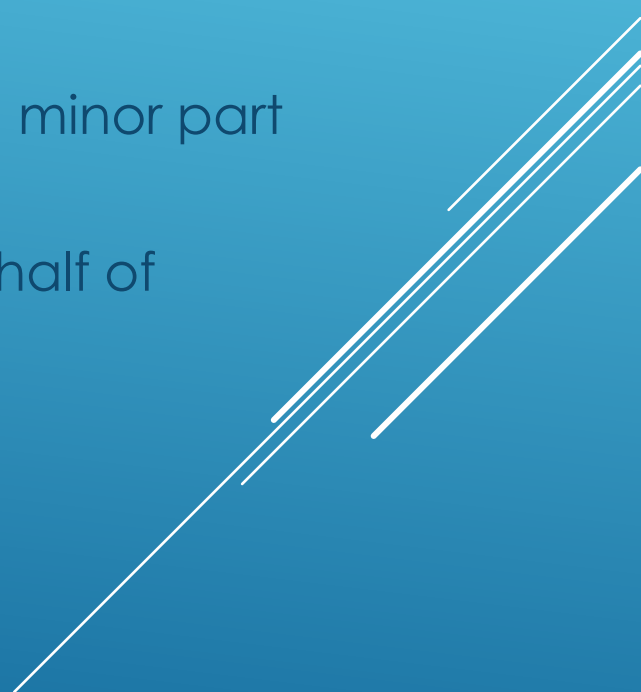

- ▶ 0= absent
 - ▶ 1= present but affecting minor part of island/peninsula
 - ▶ 2= affecting more than half of island/peninsula
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Table 1. Characteristics of study areas, sampling efforts, and observed and estimated species richness of vascular plants.

Characteristics of study areas								Impact scores [†]		Sampling effort (person-hours)	No. of samples	Sample characteristics ^g				Estimated species richness ^h	
No.	Name	Type ^a	Lat. N ^b	Long. E ^b	Max. elevation (m) ^c	Area (m ²)	Distance (km) ^e	Recreation	Birds			T	S _{obs}	Q ₁	Q ₂	S _{jack}	S _{chao}
1	Tojnak	Is	53°02'02''	106°46'02''	[20]	6120	0.30	0.50	0	3.0	4	165	64	19	9	85	79
2	Malyi Tojnak	Is	53°04'24''	106°49'38''	[15]	6575	0.86	0.25	0.25	3.0	4	160	53	8	5	61	58
3	Bolshoi Tojnak	Is	53°04'40''	106°50'05''	12	65150	1.45	0.50	0.50	4.0	4	198	80	24	18	104	92
4	Khunuk	Is	53°05'11''	106°51'39''	1.2	6110	1.00	0.50	0.25	2.0	4	181	70	16	17	84	76
5	Sarminskaya Kosa	Pns	53°05'39''	106°52'04''	0.7	5260	0	0.25	0.25	2.0	4	157	55	13	7	69	64
6	Khubyin	Is	53°05'48''	106°56'31''	33	87110	0.34	0	0.25	4.0	4	240	89	21	18	109	98
7	Shara-Dagan	Is	53°09'07''	106°58'09''	[15]	4255/100 ^d	0.67	0	1.75	0.2	1	9	9	9	0	—	—
8	Oltrek	Is	53°09'37''	106°59'21''	35	134500	1.35	0.75	0.25	5.7	4	335	141	45	25	189	171
9	Borga-Dagan	Is	53°09'46''	106°59'59''	[15]	5020	1.49	0	2	0.5	3	29	13	3	4	15	14
10	Zamogoj	Is	53°10'38''	107°06'26''	77	490100	2.63	0.25	0.25	8.0	4	385	143	37	26	181	163
11	Mys Ujuga	Pns	53°09'11''	106°57'32''	[20]	14455	0	2	0.25	2.0	4	226	98	33	24	131	115
12	Nameless	Pns	53°09'24''	106°56'57''	1.5	20	0	0	0	0.1	1	20	20	20	0	—	—
13	Nameless	Pns	53°08'59''	106°56'24''	[5]	2095	0	1.75	0	2.0	4	173	70	17	23	84	75
14	Kharantsy	Is	53°14'04''	107°24'31''	12	42800	0.17	0.75	1	3.0	4	205	83	27	16	111	100
15	Modoto	Is	53°14'09''	107°26'26''	5	1655	0.27	0	0.75	1.0	4	71	28	9	5	38	34
16	Edor	Is	53°14'41''	107°26'39''	[20]	3240/2000 ^d	0.96	0	2	1.0	4	37	12	3	0	16	15

^a Types of sampled areas: Is = island; Pns = peninsula. ^b Geographical co-ordinates refer to central parts of the sampled areas. ^c Height data in brackets are based on visual estimation. ^d total area of an island/surveyed part of an island. ^e The shortest distance between the island and mainland shorelines. [†] Means of four observations (consult the text). ^g T = total number of incidences (i.e., sums of species' records across all samples), S_{obs} = observed species richness (all samples pooled), Q₁ = the number of species found in one sample only, Q₂ = the number of species found in two samples only. ^h S_{jack} = calculated by jackknife method, S_{chao} = calculated by Chao2 method.


SPECIES TURNOVER

- ▶ Species turnover was higher on small islands than on bigger islands
 - ▶ This is opposite to what happens in the tropics
 - ▶ This is due to the small number and variety of species who can actually survive in this type of environment versus the many different species who can survive in a tropical or subtropical region
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RESULTS

- ▶ 269 species of vascular plants were recorded. The numbers ranged from 9-143
- ▶ Species richness did not differ between islands and peninsulas
- ▶ Highest proportions of unique species were found on Khunuk (15.7%) and Zamogoj (12.6%)
- ▶ Areas with large bird colonies had significantly smaller species richness than areas with small or no colonies. The current impact of tourism and recreational activities did not cause detectable changes in plant diversity.

IMPACTS OF COLONIAL BIRDS

- ▶ The Herring gull is the most common bird nesting on the Maloe More islands. Island colonies of this species totaled about 500 nests in the early 1970's and has steadily increased since then.
 - ▶ There was a more than two-fold decrease in overall species richness on islands with large gull colonies.
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CONSERVATION OF LOCAL FLORAS

- ▶ Tourists degrade and impoverish local landscapes
- ▶ Eco tourism is rare at Lake Baikal
- ▶ Restrictions should be imposed on tourist visitation to at least 3 islands thereby conserving local biodiversity
- ▶ The islands to be visited are (in the order of decreasing importance: Zamogoj, Khubyn and Khunuk)