

Table S3

Selected proteins of "Ca. Nitrospira alkalitolerans" with predicted functions in metabolic pathways and in adaptation to high alkalinity and salinity

Central Carbon Metabolism			
Glycogen formation/degradation	MaGe Identifier	Gene	Product
	NSPALKALI_v1_40047	<i>glgX</i>	Glycogen debranching enzyme
	NSPALKALI_v1_60125	<i>glgX</i>	Glycogen debranching enzyme
	NSPALKALI_v1_170014	<i>glgX</i>	Putative Glycogen debranching enzyme
	NSPALKALI_v1_40023	<i>glgP</i>	Glycogen phosphorylase
	NSPALKALI_v1_140097	<i>glgP</i>	Glycogen phosphorylase
	NSPALKALI_v1_60127	<i>glgB</i>	1,4-alpha-glucan branching enzyme
	NSPALKALI_v1_60129	<i>glgC</i>	Glucose-1-phosphate adenylyltransferase
	NSPALKALI_v1_240060	<i>glgC</i>	Glucose-1-phosphate adenylyltransferase
	NSPALKALI_v1_60051	<i>glgE</i>	Alpha-1,4-glucan:maltose-1-phosphate maltosyltransferase
	NSPALKALI_v1_680007	<i>pgm</i>	Phosphoglucomutase
	NSPALKALI_v1_30082	<i>glk</i>	Glucokinase
	NSPALKALI_v1_120061	<i>pgi</i>	Glucosephosphate isomerase
	NSPALKALI_v1_40085	<i>malQ</i>	4-alpha-glucanotransferase
	NSPALKALI_v1_360024	<i>rfbF</i>	Glucose-1-phosphate cytidylyltransferase
	NSPALKALI_v1_80165		Amylo-alpha-1,6-glucosidase
(r)TCA cycle	MaGe Identifier	Gene	Product
	NSPALKALI_v1_20059	<i>aclB</i>	ATP-citrate lyase, beta subunit
	NSPALKALI_v1_20060	<i>aclA</i>	ATP citrate lyase, alpha subunit
	NSPALKALI_v1_200042	<i>forB</i>	2-oxoglutarate:ferredoxin oxidoreductase, beta subunit
	NSPALKALI_v1_200043	<i>forC</i>	2-oxoglutarate:ferredoxin oxidoreductase, gamma subunit
	NSPALKALI_v1_200044	<i>forE</i>	2-oxoglutarate:ferredoxin oxidoreductase, epsilon subunit
	NSPALKALI_v1_200045	<i>forD</i>	2-oxoglutarate:ferredoxin oxidoreductase, delta subunit
	NSPALKALI_v1_200046	<i>forA</i>	2-oxoglutarate:ferredoxin oxidoreductase, alpha subunit
	NSPALKALI_v1_20019	<i>porD</i>	Pyruvate:ferredoxin oxidoreductase, delta subunit
	NSPALKALI_v1_20018	<i>porC</i>	Pyruvate:ferredoxin oxidoreductase, gamma subunit
	NSPALKALI_v1_20017	<i>porB</i>	Pyruvate:ferredoxin oxidoreductase, beta subunit
	NSPALKALI_v1_20016	<i>porA</i>	Pyruvate:ferredoxin oxidoreductase, alpha subunit
	NSPALKALI_v1_20015		CO dehydrogenase or Pyruvate:ferredoxin oxidoreductase, delta subunit

	NSPALKALI_v1_510019	<i>sdhA/ nadB</i>	Succinate dehydrogenase/fumarate reductase, flavoprotein subunit or L-aspartate oxidase
	NSPALKALI_v1_20130	<i>sdhA/ nadB</i>	Succinate dehydrogenase/fumarate reductase, flavoprotein subunit or L-aspartate oxidase
	NSPALKALI_v1_200063	<i>sdhA/ nadB</i>	Succinate dehydrogenase/fumarate reductase, flavoprotein subunit or L-aspartate oxidase
	NSPALKALI_v1_510021	<i>sdhC</i>	Succinate dehydrogenase, subunit C (fragment)
	NSPALKALI_v1_510020	<i>sdhB</i>	Succinate dehydrogenase/ fumarate reductase iron-sulfur protein
	NSPALKALI_v1_510018	<i>gltA</i>	Citrate synthase
	NSPALKALI_v1_750005	<i>gltA</i>	Citrate synthase 2
	NSPALKALI_v1_170072	<i>sucA</i>	Pyruvate/2-oxoglutarate dehydrogenase complex,dehydrogenase (E1) component, eukaryotic type, alpha subunit
	NSPALKALI_v1_190028		Pyruvate/2-oxoglutarate dehydrogenase complex, dehydrogenase (E1) component, eukaryotic type, alpha subunit
	NSPALKALI_v1_170073	<i>sucB</i>	Pyruvate/2-oxoglutarate dehydrogenase complex,dehydrogenase (E1) component, eukaryotic type, beta subunit
	NSPALKALI_v1_20057	<i>icd</i>	Fragment of isocitrate dehydrogenase
	NSPALKALI_v1_40102	<i>icd</i>	Putative isocitrate dehydrogenase (NADP)
	NSPALKALI_v1_40103	<i>icd</i>	Isocitrate dehydrogenase (NAD+)
	NSPALKALI_v1_100028	<i>fumC</i>	Fumarate hydratase (fumarase C),aerobic Class II
	NSPALKALI_v1_580009	<i>mdh</i>	Malate dehydrogenase
	NSPALKALI_v1_200065	<i>sucC</i>	Succinyl-CoA ligase [ADP-forming], subunit alpha
	NSPALKALI_v1_200064	<i>sucD</i>	Succinyl-CoA ligase [ADP-forming] subunit beta
	NSPALKALI_v1_200061	<i>acnA</i>	aconitate hydratase 1
	NSPALKALI_v1_90082	<i>lpdA</i>	2-oxo-acid dehydrogenase complex, Dihydrolipoamide dehydrogenase (E3) (fragment)
Carbonate uptake	MaGe Identifier	Gene	Product
	NSPALKALI_v1_30038	<i>bicA</i>	Bicarbonate transporter BicA or sulfate permease
	NSPALKALI_v1_40075	<i>bicA</i>	Bicarbonate transporter BicA or sulfate permease
	NSPALKALI_v1_120088		Carbonic anhydase
	NSPALKALI_v1_550019		Carbonic anhydase
Hydrogen Metabolism			
Hydrogen Metabolism	MaGe Identifier	Gene	Product
	NSPALKALI_v1_490036		Putative (NiFe) hydrogenase, beta subunit (group 3b)
	NSPALKALI_v1_160002		Nickel-dependent hydrogenase, large subunit (group 3b)
	NSPALKALI_v1_500001		Hydrogenase transcriptional regulatory protein HoxA
	NSPALKALI_v1_500003		Ni,Fe-hydrogenase, small subunit (group 2a)
	NSPALKALI_v1_500004		Ni,Fe-hydrogenase, large subunit (group 2a)
	NSPALKALI_v1_500007		Hydrogenase maturation protein (fragment)
	NSPALKALI_v1_500014	<i>hypF</i>	Hydrogenase maturation protein
	NSPALKALI_v1_500015	<i>hypC</i>	Hydrogenase assembly chaperone protein

	NSPALKALI_v1_500017	<i>hypD</i>	hydrogenase expression/ formation protein
	NSPALKALI_v1_500018	<i>hypE</i>	hydrogenase expression/ formation protein
	NSPALKALI_v1_500020	<i>hypA</i>	putative hydrogenase nickel incorporation protein
	NSPALKALI_v1_500021	<i>hypB</i>	hydrogenase accessory protein
Nitrite Metabolism			
Nitrite oxidation	MaGe Identifier	Gene	Product
	NSPALKALI_v1_140038	<i>nxrB</i>	Nitrite oxidoreductase beta subunit
	NSPALKALI_v1_140037	<i>nxrA</i>	Nitrite oxidoreductase alpha subunit
	NSPALKALI_v1_530013	<i>nxrA</i>	Nitrite oxidoreductase alpha subunit
	NSPALKALI_v1_530020	<i>nxrA</i>	Nitrite oxidoreductase alpha subunit (fragment)
	NSPALKALI_v1_150108	<i>nxrC</i>	Putative nitrite oxidoreductase, gamma subunit
	NSPALKALI_v1_70126	<i>nxrC</i>	Nitrite oxidoreductase gamma subunit
	NSPALKALI_v1_70134	<i>nxrC</i>	Nitrite oxidoreductase gamma subunit
Respiratory Chain			
Complex I	MaGe Identifier	Gene	Product
	NSPALKALI_v1_400013	<i>nuoA</i>	NADH-quinone oxidoreductase subunit A
	NSPALKALI_v1_400014	<i>nuoB</i>	NADH-quinone oxidoreductase subunit B
	NSPALKALI_v1_400015	<i>nuoC/D</i>	NADH-quinone oxidoreductase subunit C/D
	NSPALKALI_v1_400016	<i>nuoE</i>	NADH-quinone oxidoreductase subunit E
	NSPALKALI_v1_400017	<i>nuoF</i>	NADH-quinone oxidoreductase, subunit F
	NSPALKALI_v1_400018	<i>nuoG</i>	NADH-quinone oxidoreductase, subunitG
	NSPALKALI_v1_400019	<i>nuoH</i>	NADH-quinone oxidoreductase subunit H
	NSPALKALI_v1_400020	<i>nuoI</i>	NADH-quinone oxidoreductase subunit I
	NSPALKALI_v1_400021	<i>nuoJ</i>	NADH-quinone oxidoreductase, membrane subunit J
	NSPALKALI_v1_400022	<i>nuoK</i>	NADH-quinone oxidoreductase subunit K
	NSPALKALI_v1_400023	<i>nuoL</i>	NADH-quinone oxidoreductase, membrane subunit L
	NSPALKALI_v1_400024	<i>nuoM</i>	NADH-quinone oxidoreductase subunit M
	NSPALKALI_v1_400025	<i>nuoN</i>	NADH-quinone oxidoreductase subunit N2
	NSPALKALI_v1_250014	<i>nuoA</i>	NADH-quinone oxidoreductase subunit A
	NSPALKALI_v1_250015	<i>nuoB</i>	NADH-quinone oxidoreductase subunit B
	NSPALKALI_v1_250016	<i>nuoC</i>	NADH-quinone oxidoreductase subunit C
	NSPALKALI_v1_250017	<i>nuoD</i>	NADH-quinone oxidoreductase subunit D
	NSPALKALI_v1_250018	<i>nuoG</i>	NADH-quinone oxidoreductase, subunitG
	NSPALKALI_v1_250019	<i>nuoI</i>	NADH-quinone oxidoreductase subunit I

	NSPALKALI_v1_250020	<i>nuoJ</i>	NADH-quinone oxidoreductase, membrane subunit J
	NSPALKALI_v1_250021	<i>nuoK</i>	NADH-quinone oxidoreductase subunit K
	NSPALKALI_v1_250022	<i>nuoL</i>	NADH-quinone oxidoreductase, membrane subunit L
	NSPALKALI_v1_250023	<i>nuoM</i>	NADH-quinone oxidoreductase, membrane subunit M
	NSPALKALI_v1_250024	<i>nuoM</i>	NADH-quinone oxidoreductase, membrane subunit M
	NSPALKALI_v1_250025	<i>nuoN</i>	NADH-quinone oxidoreductase subunit N
	NSPALKALI_v1_580010	<i>nuoF</i>	NADH-quinone oxidoreductase subunit F 2
Complex II	MaGe Identifier	Gene	Product
	NSPALKALI_v1_510019	<i>sdhA/ nadB</i>	Succinate dehydrogenase/fumarate reductase, flavoprotein subunit or L-aspartate oxidase
	NSPALKALI_v1_510020	<i>sdhB</i>	Succinate dehydrogenase/ fumarate reductase iron-sulfur protein
	NSPALKALI_v1_510021	<i>sdhC</i>	Succinate dehydrogenase, subunit C (fragment)
	NSPALKALI_v1_20130	<i>sdhA/ nadB</i>	Succinate dehydrogenase/fumarate reductase, flavoprotein subunit or L-aspartate oxidase
	NSPALKALI_v1_200063	<i>sdhA/ nadB</i>	Succinate dehydrogenase/fumarate reductase, flavoprotein subunit or L-aspartate oxidase
Complex III	MaGe Identifier	Gene	Product
	NSPALKALI_v1_150103		Putative Quinol-cytochrome c reductase, cytochrome b subunit
	NSPALKALI_v1_150102		Putative Quinol-cytochrome c reductase, iron-sulfur subunit, modulated with PRC-barrel (Modular protein)
	NSPALKALI_v1_370011		Menaquinol-cytochrome c reductase cytochrome b subunit
	NSPALKALI_v1_370010		Putative Quinol-cytochrome c reductase, iron-sulfur subunit (Rieske iron-sulfur protein)
Complex IV	MaGe Identifier	Gene	Product
	NSPALKALI_v1_150105		Putative Cytochrome bd-type quinol oxidase subunit 1
	NSPALKALI_v1_530011		Putative Cytochrome bd-type quinol oxidase, subunit 1
	NSPALKALI_v1_70108		Cytochrome bd ubiquinol oxidase subunit I
	NSPALKALI_v1_220083		Putative Cytochrome bd ubiquinol oxidase, subunit I
	NSPALKALI_v1_220084		Putative Cytochrome bd ubiquinol oxidase, subunit II
Complex V	MaGe Identifier	Gene	Product
	NSPALKALI_v1_10079	<i>atpH</i>	ATP synthase subunit delta
	NSPALKALI_v1_10080	<i>atpA</i>	F1 sector of membrane-bound ATP synthase, alpha subunit
	NSPALKALI_v1_10081	<i>atpD</i>	Membrane-bound ATP synthase , F1 sector, beta-subunit
	NSPALKALI_v1_10082	<i>atpC</i>	ATP synthase epsilon chain
	NSPALKALI_v1_790004	<i>atpA</i>	ATP synthase subunit alpha 2
	NSPALKALI_v1_20126	<i>atpI</i>	Putative ATP synthase F0, subunit I
	NSPALKALI_v1_20125	<i>atpB</i>	ATP synthase subunit a
	NSPALKALI_v1_20124	<i>atpE</i>	ATP synthase subunit c
	NSPALKALI_v1_20123	<i>atpF</i>	ATP synthase subunit b

	NSPALKALI_v1_120045	<i>atpG</i>	ATP synthase gamma chain
	NSPALKALI_v1_330007	<i>atpG</i>	ATP synthase gamma chain
	NSPALKALI_v1_10070	<i>yidC</i>	Membrane protein insertase YidC
Iron uptake and storage			
	MaGe Identifier	Gene	Product
	NSPALKALI_v1_170059		Bacterioferritin (modular protein)
	NSPALKALI_v1_60072		Bacterioferritin, iron storage and detoxification protein
	NSPALKALI_v1_80012	<i>fecE</i>	Iron-dicitrate transporter
	NSPALKALI_v1_110032	<i>fur</i>	Ferric uptake regulation protein
	NSPALKALI_v1_10210	<i>fur</i>	Ferric uptake regulation protein
	NSPALKALI_v1_58005		putative Bacterioferritin-associated ferredoxin
	NSPALKALI_v1_460022		putative TonB-dependent receptor
	NSPALKALI_v1_250054		putative TonB-dependent receptor
	NSPALKALI_v1_570021		putative TonB-dependent receptor
	NSPALKALI_v1_110038		putative TonB-dependent receptor
	NSPALKALI_v1_340011		putative TonB-dependent receptor
	NSPALKALI_v1_400004		putative Protein tonB2
	NSPALKALI_v1_400007	<i>exbB</i>	Biopolymer transport protein
	NSPALKALI_v1_570025	<i>exbD</i>	Biopolymer transport protein
	NSPALKALI_v1_570024	<i>exbD</i>	Biopolymer transport protein
	NSPALKALI_v1_140114	<i>exbD</i>	Biopolymer transport protein
Flagellum biosynthesis			
Flagellum assembly	MaGe Identifier	Gene	Product
	NSPALKALI_v1_190007	<i>motA</i>	Flagellar motor protein MotA
	NSPALKALI_v1_190008	<i>motB</i>	Flagellar motor protein MotB
	NSPALKALI_v1_140115		MotA/TolQ/ExbB proton channel family protein
	NSPALKALI_v1_30036	<i>ompA/ motB</i>	putative OmpA/MotB
K⁺ transport			
K⁺ uptake	MaGe Identifier	Gene	Product
	NSPALKALI_v1_150036		putative potassium channel NAD-binding component
	NSPALKALI_v1_270047	<i>trkC</i>	Trk system potassium uptake protein C
	NSPALKALI_v1_170093	<i>trkB</i>	Trk system potassium uptake protein B
	NSPALKALI_v1_100131	<i>trkB</i>	Trk system potassium uptake protein B
K⁺ efflux	MaGe Identifier	Gene	Product

	NSPALKALI_v1_160038	<i>kefB</i>	putative K(+) efflux antiporter KefB
	NSPALKALI_v1_30114	<i>kefB</i>	Putative Glutathione-regulated potassium-efflux system
	NSPALKALI_v1_30115	<i>kefB</i>	Putative Glutathione-regulated potassium-efflux system
Na⁺ transport			
Sodium import	MaGe Identifier	Gene	Product
	NSPALKALI_v1_50050		Sodium/solute symporter, putative (fragment)
	NSPALKALI_v1_140059		Sodium:dicarboxylate symporter
	NSPALKALI_v1_150072		Uncharacterized sodium-dependent transporter YhdH
	NSPALKALI_v1_110138	<i>agcS</i>	Sodium/alanine symporter
	NSPALKALI_v1_30038	<i>bicA</i>	Bicarbonate transporter BicA or sulfate permease
	NSPALKALI_v1_40075	<i>bicA</i>	Bicarbonate transporter BicA or sulfate permease
Sodium/ cation exchange	MaGe Identifier	Gene	Product
	NSPALKALI_v1_380014		Sodium/calcium exchanger
	NSPALKALI_v1_90107	<i>nhaA</i>	sodium:proton antiporter
	NSPALKALI_v1_30009	<i>nhaB</i>	fragment of sodium:proton antiporter (part 2)
	NSPALKALI_v1_30007	<i>nhaB</i>	fragment of sodium:proton antiporter (part 1)
	NSPALKALI_v1_30027	<i>mrpE</i>	putative Monovalent cation/H ⁺ antiporter, subunit E
	NSPALKALI_v1_30028	<i>mrpF</i>	putative Monovalent cation/H ⁺ antiporter, subunit F
	NSPALKALI_v1_30029	<i>mrpG</i>	putative Monovalent cation/H ⁺ antiporter, subunit G
	NSPALKALI_v1_30030	<i>mrpA</i>	putative Monovalent cation/H ⁺ antiporter, subunit A (Fragment, part 3)
	NSPALKALI_v1_30031	<i>mrpB</i>	putative Monovalent cation/H ⁺ antiporter, subunit B
	NSPALKALI_v1_30032	<i>mrpC</i>	putative Monovalent cation/H ⁺ antiporter, subunit C
	NSPALKALI_v1_30033	<i>mrpD</i>	putative Monovalent cation/H ⁺ antiporter, subunit D
	NSPALKALI_v1_30034	<i>mrpA/D (nuoL)</i>	putative Monovalent cation/H ⁺ antiporter, subunit A or D
	NSPALKALI_v1_30035	<i>mrpA/D (nuoM)</i>	putative Monovalent cation/H ⁺ antiporter, subunit A or D
	NSPALKALI_v1_30037	<i>nhaB</i>	sodium:proton antiporter
	NSPALKALI_v1_40053	<i>mrpD</i>	putative Monovalent cation/H ⁺ antiporter, subunit D
	NSPALKALI_v1_40054	<i>mrpC</i>	putative Monovalent cation/H ⁺ antiporter, subunit C
	NSPALKALI_v1_40055	<i>mrpB</i>	putative Monovalent cation/H ⁺ antiporter, subunit B
	NSPALKALI_v1_40056	<i>mrpA/B</i>	putative Monovalent cation/H ⁺ antiporter, subunit A or B
	NSPALKALI_v1_40057	<i>mrpG/ phaG</i>	Monovalent cation/proton antiporter, MnhG/PhaG subunit
	NSPALKALI_v1_40058	<i>mrpF</i>	putative Monovalent cation/H ⁺ antiporter, subunit F (Multiple resistance and pH regulation protein F)
	NSPALKALI_v1_40059	<i>mrpE</i>	putative Monovalent cation/H ⁺ antiporter, subunit E
Na⁺ translocating complex I			

Alternative complex I	MaGe Identifier	Gene	Product
	NSPALKALI_v1_330010	<i>nqrA</i>	Na(+)-translocating NADH-quinone reductase subunit A
	NSPALKALI_v1_330011	<i>nqrB</i>	Na(+)-translocating NADH-quinone reductase subunit B
	NSPALKALI_v1_330013	<i>nqrC</i>	Na(+)-translocating NADH-quinone reductase subunit C
	NSPALKALI_v1_330014	<i>nqrD</i>	Na(+)-translocating NADH-quinone reductase subunit D
	NSPALKALI_v1_330015	<i>nqrE</i>	Na(+)-translocating NADH-quinone reductase subunit E
	NSPALKALI_v1_330016	<i>nqrF</i>	Na(+)-translocating NADH-quinone reductase subunit F
cbb3-type complex IV			
Alternative complex IV	MaGe Identifier	Gene	Product
	NSPALKALI_v1_40069		Putative Cytochrome c oxidase (cbb3-type), fused subunits I, II, and III
N-type ATPase			
Alternative Complex V	MaGe Identifier	Gene	Product
	NSPALKALI_v1_440034	<i>atpD</i>	ATP synthase subunit beta
	NSPALKALI_v1_440035	<i>atpC</i>	H(+)-transporting ATP synthase, subunit epsilon
	NSPALKALI_v1_440036	<i>atpQ</i>	H(+)-transporting ATP synthase subunit q
	NSPALKALI_v1_440037	<i>atpR</i>	F1/F0 ATPase, Methanosarcina type, subunit r
	NSPALKALI_v1_440038	<i>atpB</i>	ATP synthase subunit a
	NSPALKALI_v1_790001	<i>atpB</i>	ATP synthase subunit a
	NSPALKALI_v1_790002	<i>atpE</i>	ATP synthase subunit c 2
	NSPALKALI_v1_790003	<i>atpF</i>	ATP synthase subunit b 2
	NSPALKALI_v1_790004	<i>atpA</i>	ATP synthase subunit alpha 2
	NSPALKALI_v1_330002	<i>atpG</i>	ATP synthase subunit gamma
Osmoprotectants			
Glutamate synthesis	MaGe Identifier	Gene	Product
	NSPALKALI_v1_70075	<i>gltB</i>	Glutamate synthase [NADPH], large subunit
	NSPALKALI_v1_70076	<i>gltD</i>	Glutamate synthase [NADPH], small chain
	NSPALKALI_v1_140012	<i>glt</i>	Putative glutamate synthase (Zinc finger CDGSH-type domain protein)
	NSPALKALI_v1_40009	<i>glt</i>	Putative glutamate synthase (Zinc finger CDGSH-type domain protein)
Glycine betaine import	MaGe Identifier	Gene	Product
	NSPALKALI_v1_140025	<i>opuD</i>	Glycine betaine transporter
	NSPALKALI_v1_20246	<i>opuCB</i>	ABC-type glycine betaine transport, periplasmic subunit
Trehalose synthesis	MaGe Identifier	Gene	Product
	NSPALKALI_v1_60049	<i>treS</i>	Trehalose synthase
Other			

Pathway	MaGe Identifier	Gene	Product
Membrane adaptation	NSPALKALI_v1_490030	<i>cls</i>	Cardiolipin synthase
Arsenical resistance	NSPALKALI_v1_370005	<i>arsB/acr3</i>	Arsenite efflux pump ArsB, ACR3 family