Tracing the Tin Flows and Stocks in China: A Dynamic Material Flow Analysis from 2001 to 2022

Supplementary Information for Tables

Table S1. The tin contents of various trade tin-containing products

	Code	Product	Content
Electronics	85171300	Smartphones	6 g/unit
	847130	Portable automatic data processing equipment, weighing ≤ 10 kilograms Portable automatic data-processing machines, weighing not more than 10 kg	3 g/unit
	8703	Motor cars and other motor vehicles principally designed for the transport of <10 persons, incl. station wagons and racing cars (excl. motor vehicles of heading 8702)	0.5 kg/unit
	85071000	Lead acid batteries for starting piston engines	1.27%
	85072000	Other lead-acid batteries	1.27%
Home appliances	8450	Household or laundry-type washing machines, incl. machines which both wash and dry; parts thereof	50 g/unit
	852872	Reception apparatus for television, color, whether or not incorporating radio-broadcast receivers or sound or video recording or reproducing apparatus, designed to incorporate a video display or screen	50 g/unit
	841810	Combined refrigerator-freezers, with separate external doors or drawers, or combinations thereof	60 g/unit
	841510	Air conditioning machines designed to be fixed to a window, wall, ceiling or floor, self-contained or "split-system"	50 g/unit
	841451	Fans, with a self-contained electric motor of an output <= 125 W	40 g/unit
Construction	7005	Float glass and surface ground or polished glass, in sheets, whether or not having an absorbent, reflecting or non-reflecting layer, but not otherwise worked	0.2 g/unit
Machinery	84833000	Bearing block without ball or roller bearings; sliding bearing	40%
Food packaging	72101200	Ordinary steel plate coated or tinned, thickness < 0.5mm	0.0028 g/unit
Aerospace	84091000	Parts suitable for use solely or principally with internal combustion piston engine for aircraft, n.e.s	40%

Table S2. Loss of tin in various stages

	Loss ratio
Beneficiation	10%
Smelting	10%
Manufacturing	10%

Table S3. Lifespan of tin-containing final products

End-use product	Average lifespan	Source
Electronics	4.64	Guo et al. [1]
Information	4.64	Guo et al. [1]
Home appliances	6.36	Guo et al. [1]
Chemicals	2	Liu et al. [2]
Construction	28.9	Huang et al. [3]
Machinery	18	Li et al. [4]
Food packaging	3	CBC database [5]
Atomic energy	7.1	Zheng et al. [6]
Aerospace	30	Zheng et al. [6]

Table S4. Amount of China's tin consumption from 2001 to 2022 (Unit: Kt tin)

	Electronics	Information	Home appliances	Chemicals	Construction	Machinery	Food packaging	Atomic energy	Aerospace
2001	4.5	7.1	8.7	5.6	1.0	11.2	9.6	0.6	1.0
2002	5.2	7.8	10.3	5.7	1.1	12.1	9.7	0.6	1.0
2003	5.4	8.2	13.3	4.1	1.3	12.2	10.1	0.7	1.2
2004	8.9	8.7	15.5	7.5	1.5	11.8	11.2	0.9	1.7
2005	10.1	8.9	15.0	8.2	1.8	12.5	12.2	1.0	1.8
2006	11.3	9.4	16.6	8.5	2.0	13.1	13.9	1.1	1.9
2007	12.8	9.6	18.2	9.8	2.5	13.6	14.0	1.4	2.2
2008	13.0	9.9	19.0	8.4	2.8	11.0	12.3	1.7	2.3
2009	16.3	10.4	19.9	9.4	2.8	11.6	12.9	1.8	2.5
2010	22.0	10.7	24.0	12.5	3.2	9.8	13.8	1.9	2.6
2011	24.7	10.8	26.8	13.4	3.7	8.9	15.3	1.9	2.7
2012	26.8	11.2	25.1	14.2	3.6	9.4	16.5	2.1	3.0
2013	31.3	11.3	25.5	16.1	3.9	9.4	18.8	2.4	3.4
2014	33.1	11.6	27.0	16.9	4.0	9.8	19.0	4.8	5.2
2015	34.9	11.8	26.9	16.5	3.7	9.6	20.1	4.5	5.3
2016	40.3	12.1	28.1	17.9	3.9	11.1	23.2	5.2	6.1
2017	41.0	12.2	30.4	18.4	4.0	8.8	20.0	5.7	6.1
2018	37.9	12.6	34.6	18.9	4.3	7.7	28.4	5.0	5.4
2019	35.3	12.7	35.2	20.7	4.6	6.8	28.4	4.4	4.8
2020	38.4	10.5	36.7	21.0	4.7	4.9	24.7	3.1	3.6
2021	41.8	10.7	37.1	23.1	5.1	5.6	25.9	4.4	4.8
2022	47.3	12.4	25.2	25.9	5.1	8.1	27.4	4.6	5.5

Table S5. Production of tin concentrate in China from 2001 to 2022

	Amount (Kt tin)
2001	92.9
2002	61.7
2003	101.8
2004	118.2
2005	125.6
2006	126.3
2007	145.9
2008	85.5
2009	97.2
2010	91.4
2011	94.1
2012	91.0
2013	101.2
2014	102.1
2015	110.2
2016	97.2
2017	95.5
2018	94.8
2019	91.1
2020	94.5
2021	75.1
2022	80.2

Supplementary Information for Figures

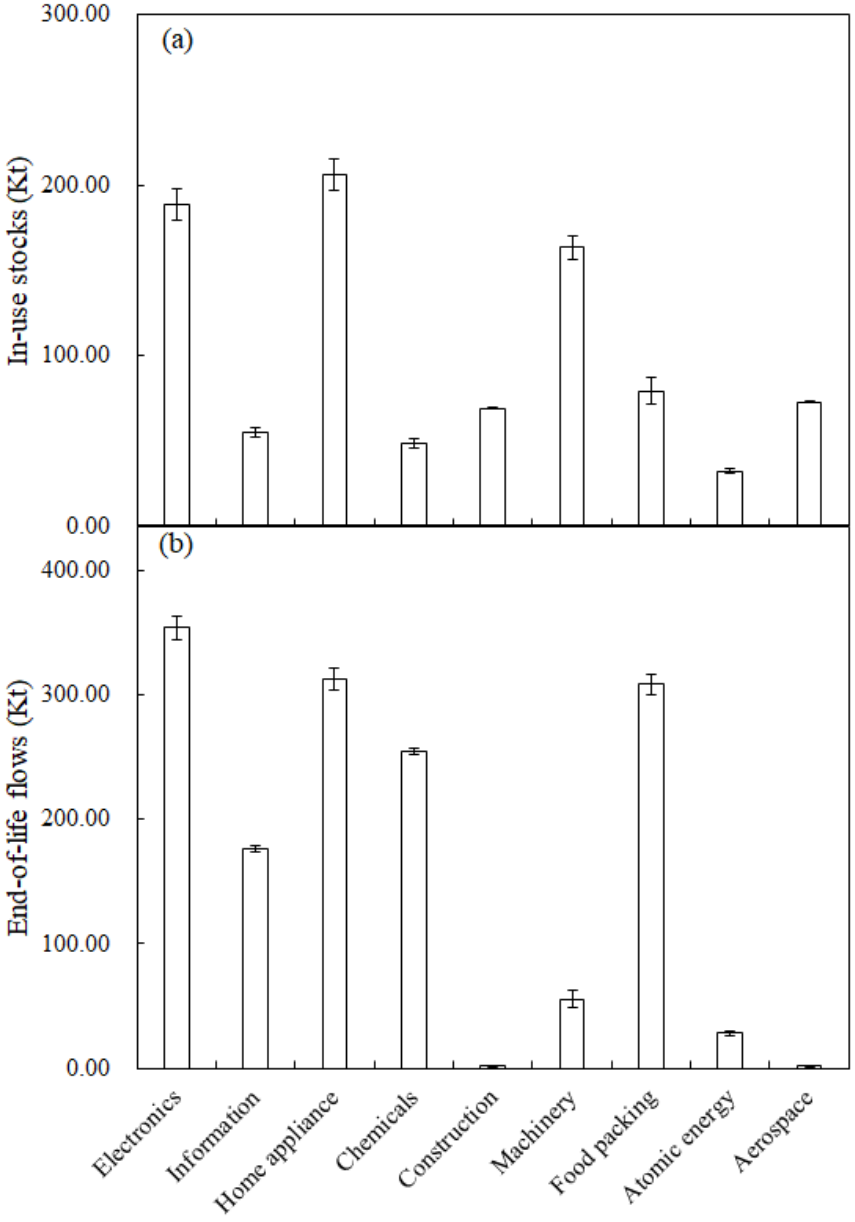

Figure S1. Uncertainty analysis of cumulative in-use stocks and end-of-life flows

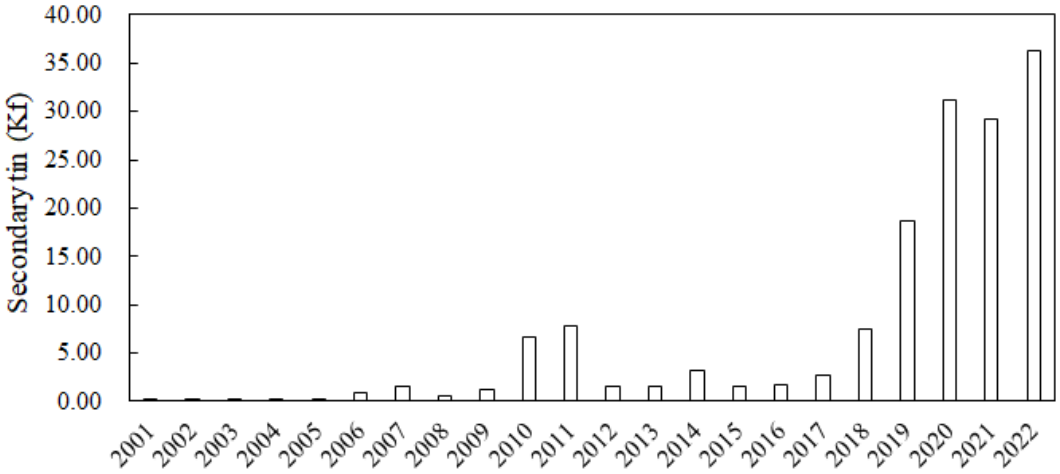

Figure S2. Production of secondary tin in China from 2001 to 2022

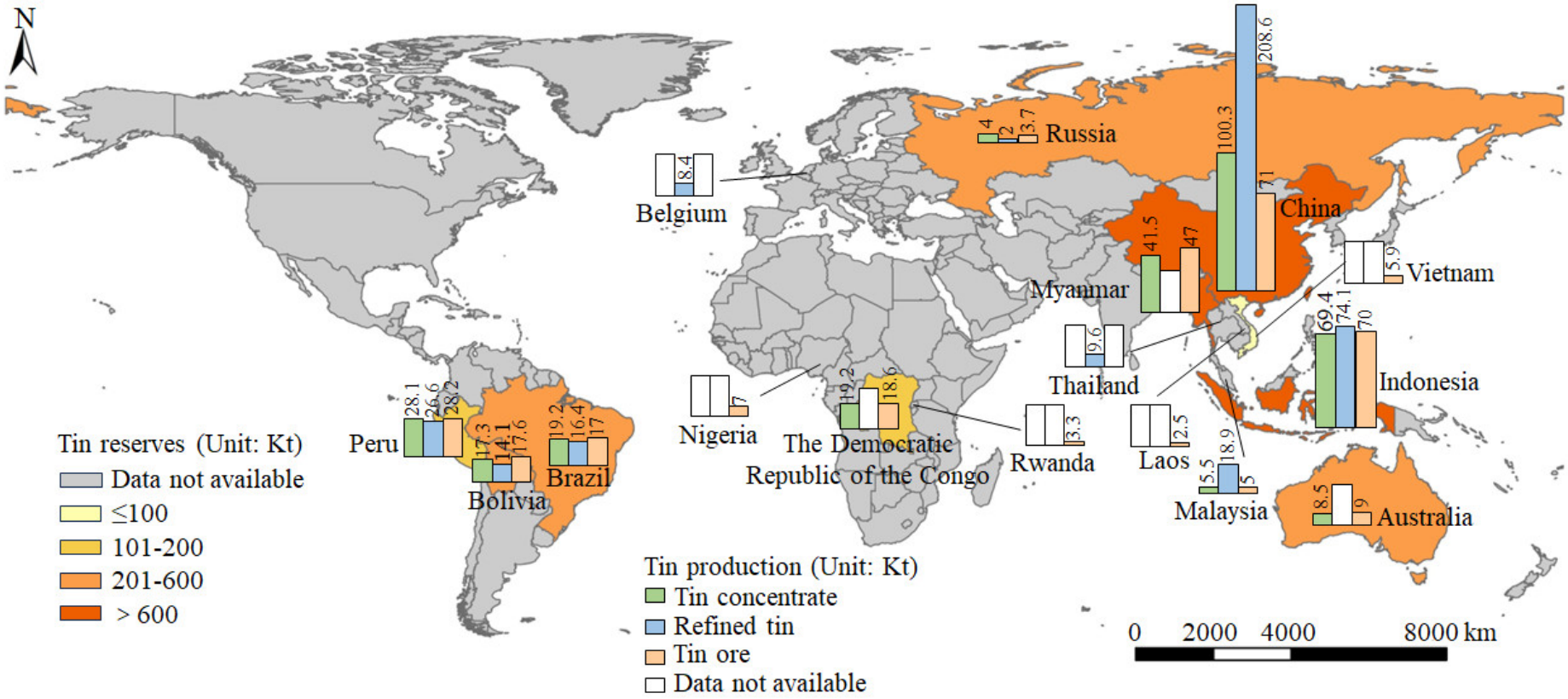

Figure S3. Global tin reserves and tin production in 2022

References

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