

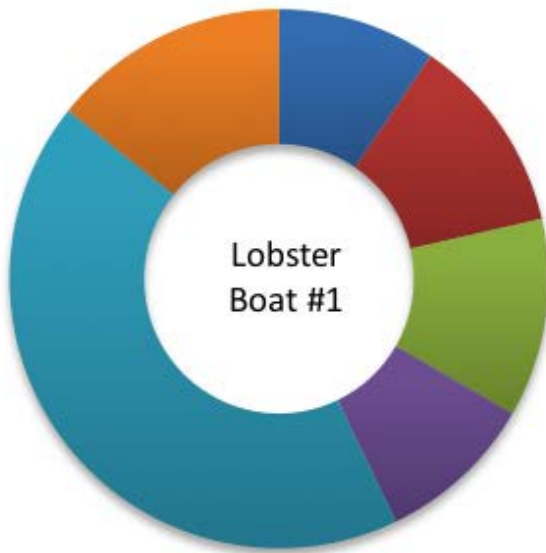


Small Craft Emissions Electrification opportunities

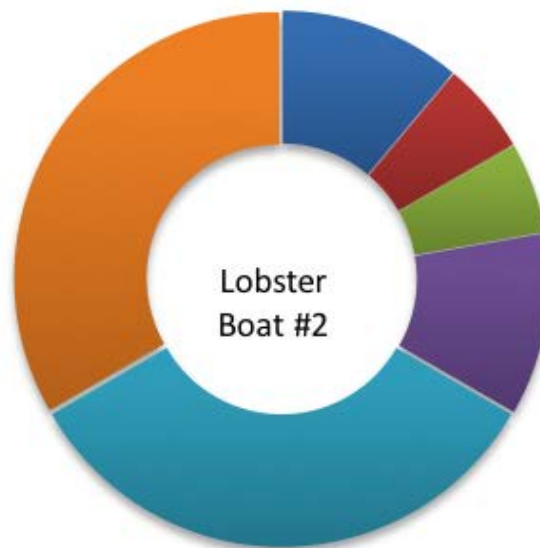
Dr. Sue Molloy, P.Eng., Glas Ocean Electric

How do smaller boats use power?

Key - Operational Profiles



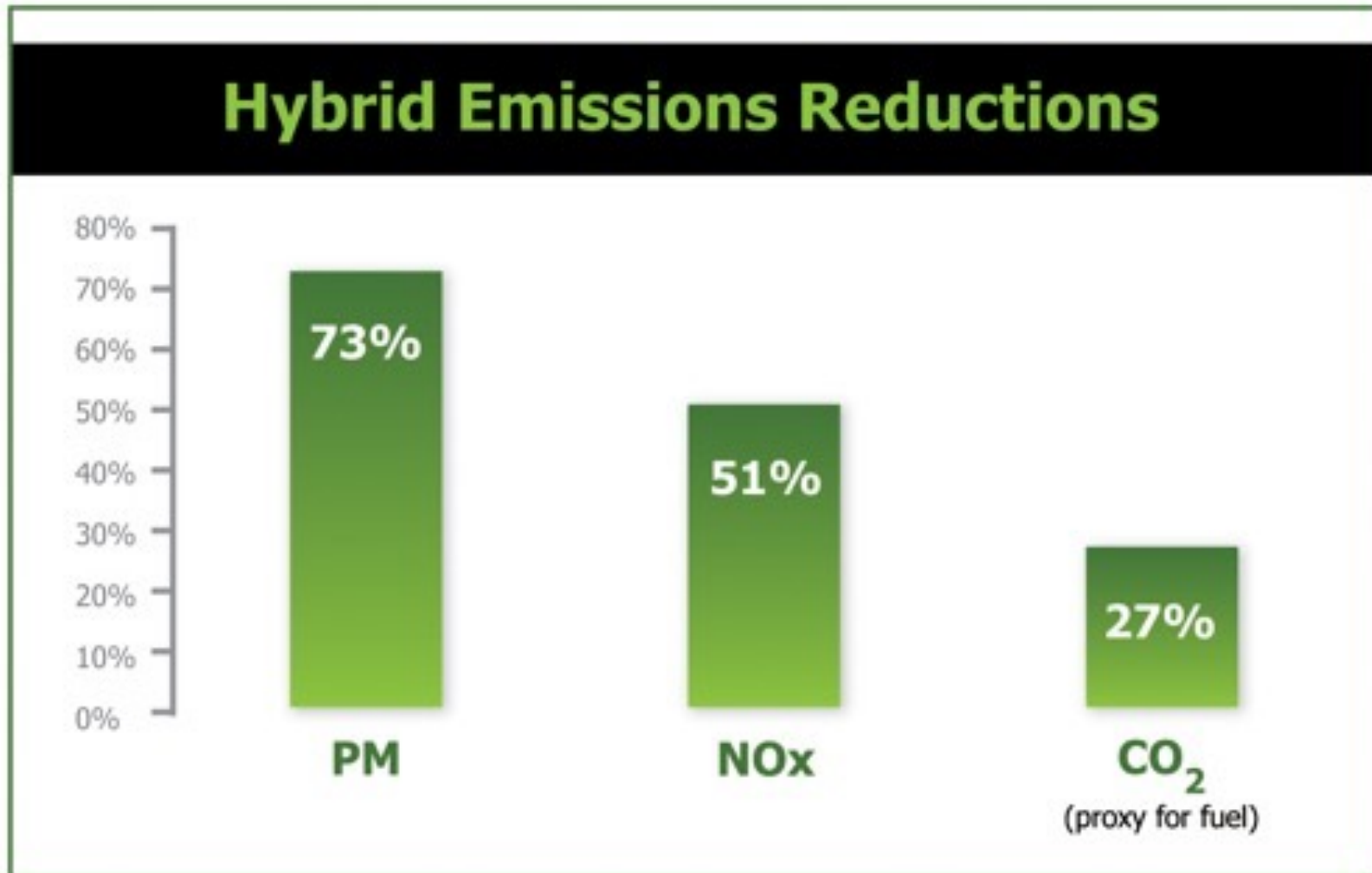
- Dock to Fishing Grounds
- Hauling
- Cruising speed to traps
- Return to Port
- Generator
- Shore Power



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Hybrid Tug Emissions results

California Study



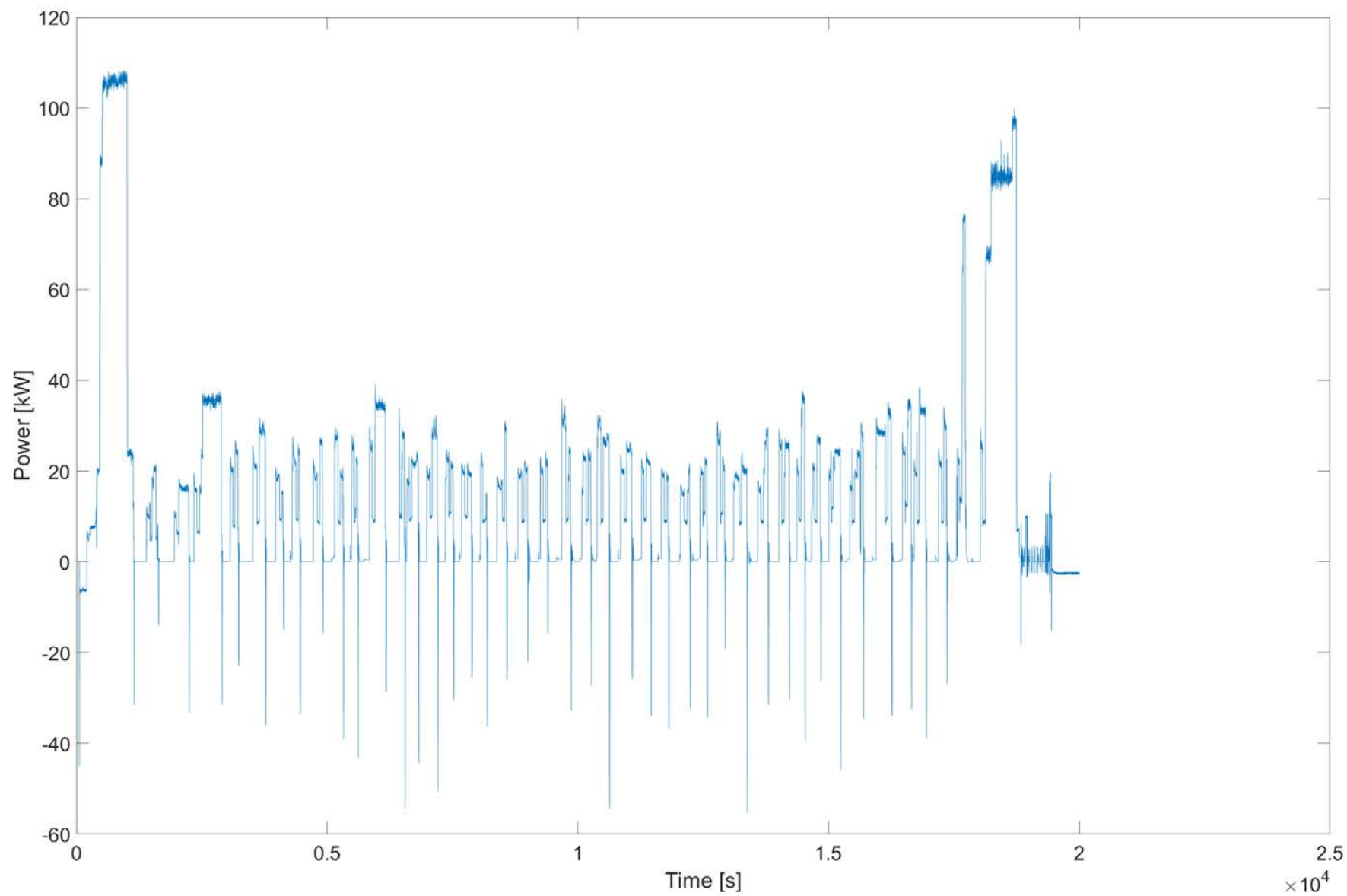
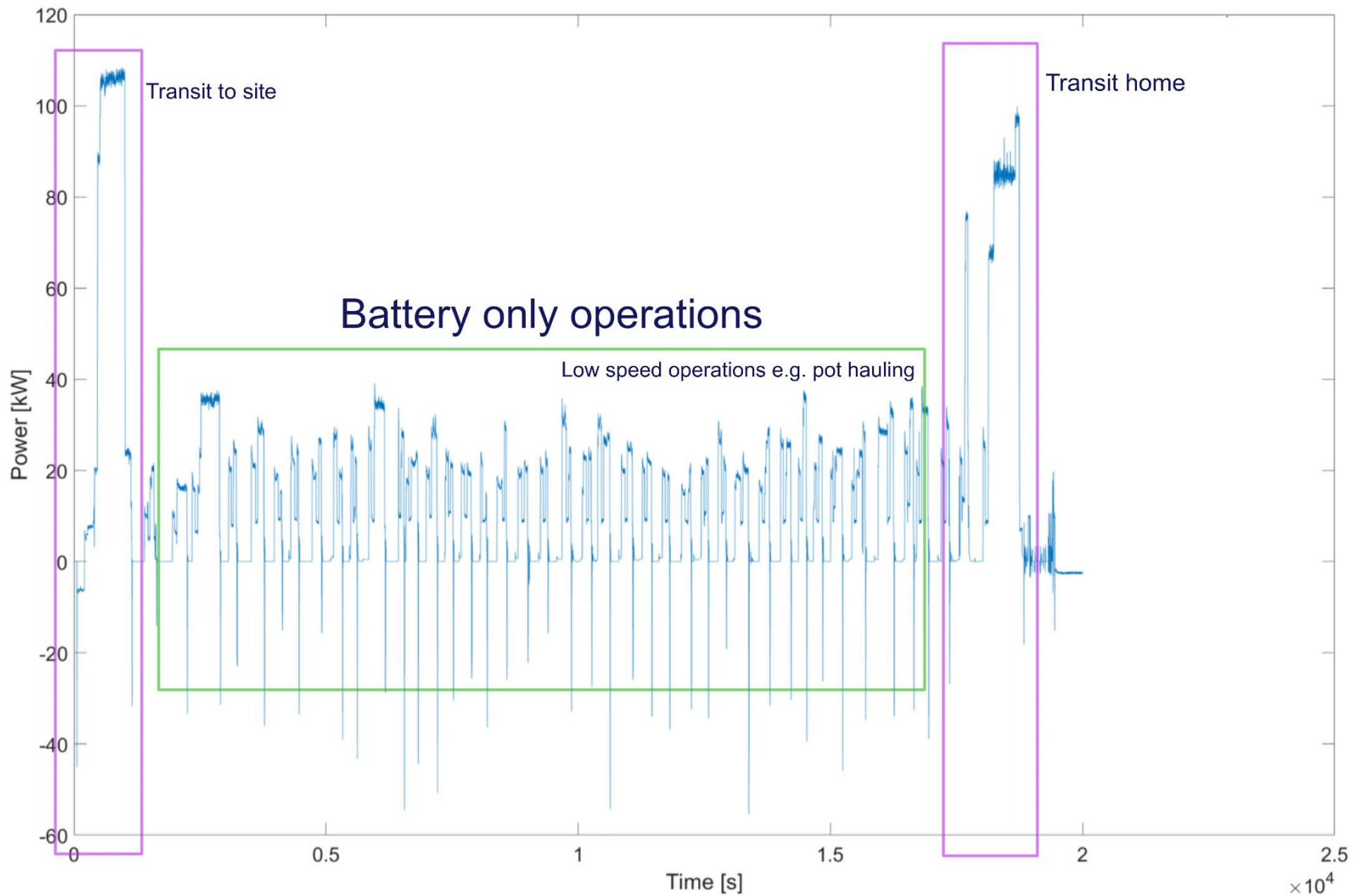
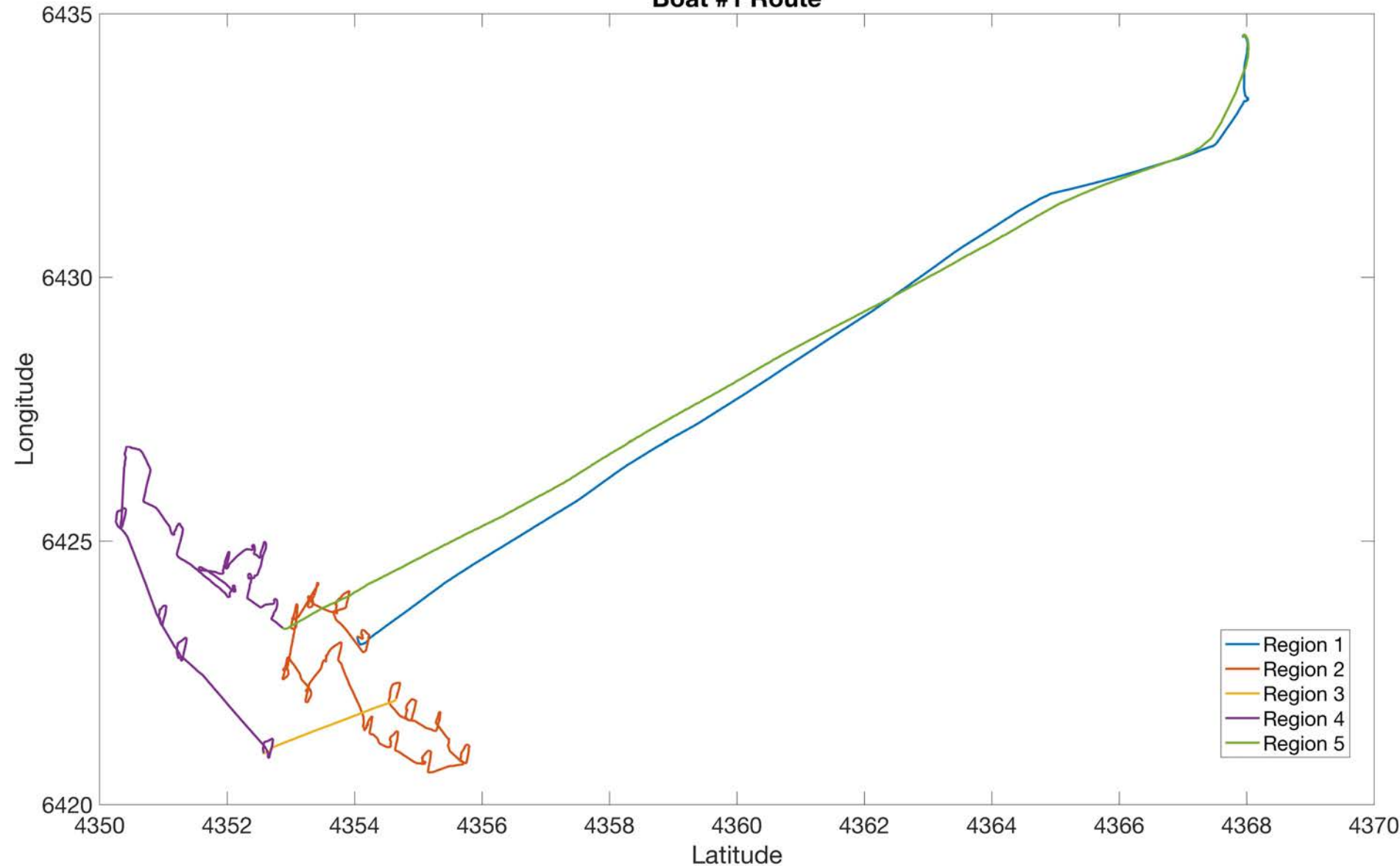


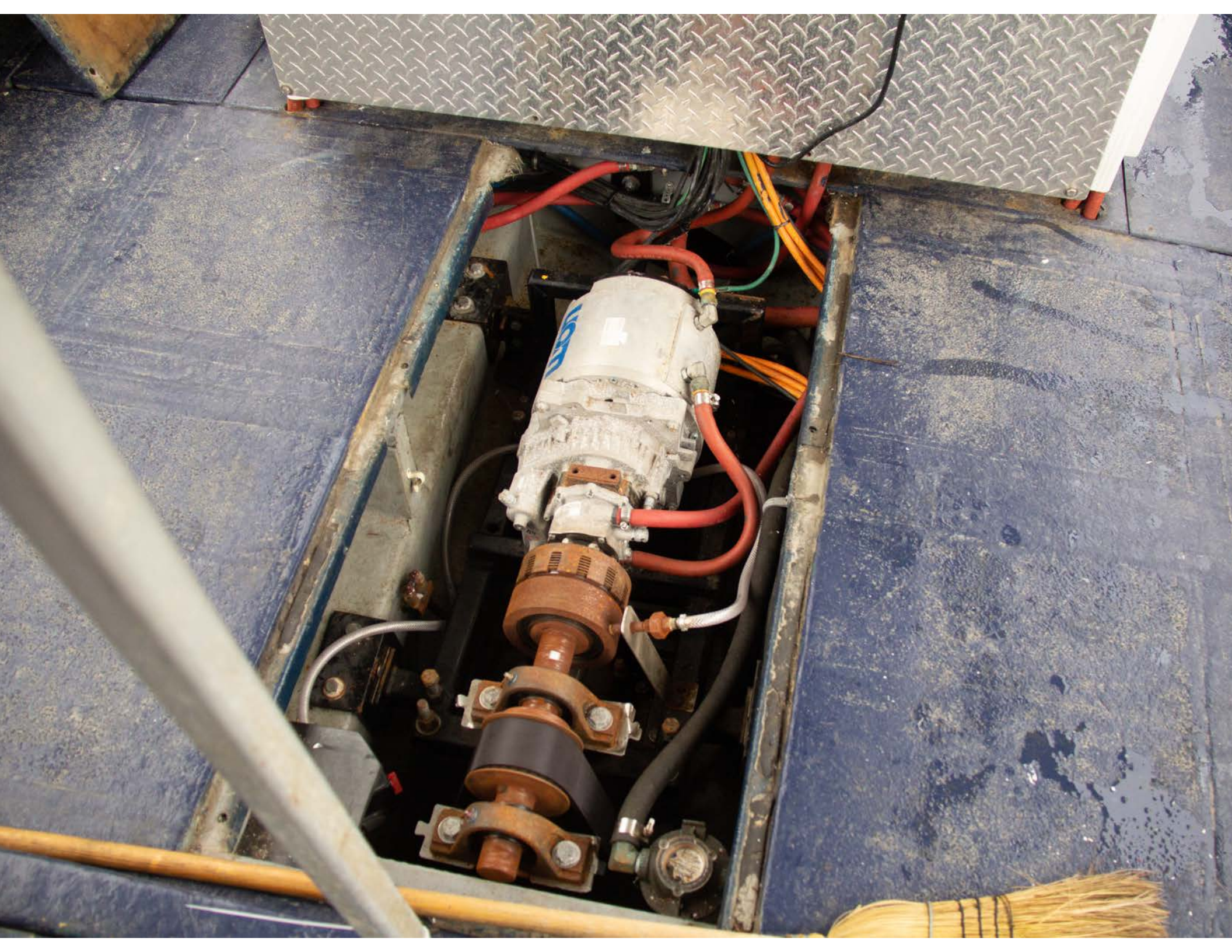
Fig. 3: Time Series Output Power Data



Boat #1 Route







FUEL VENT





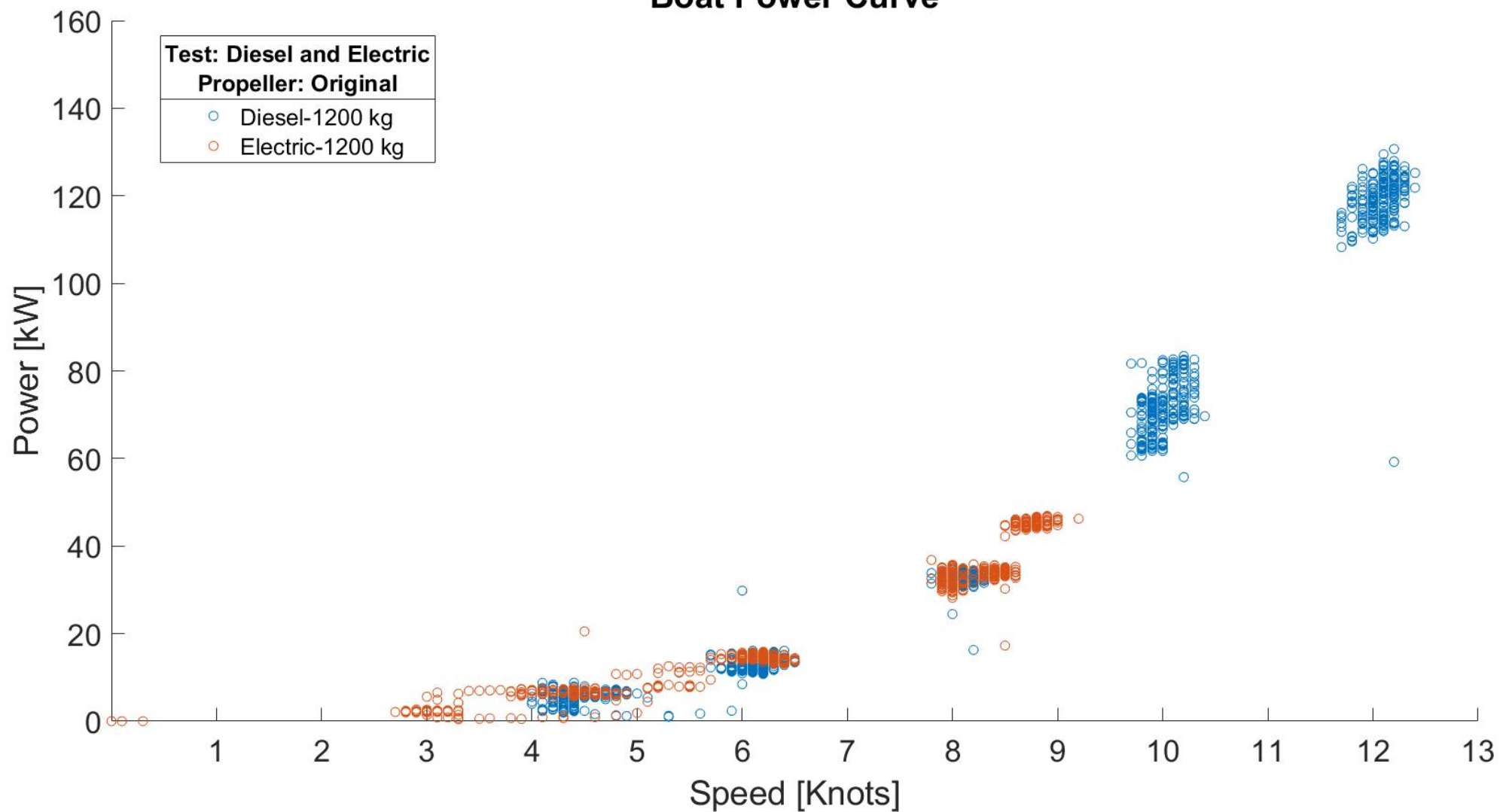
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	Current	Min	Avg	SD	Max	Units
Efficiency	OVER		No Cal	No Cal	OVER	%
T Ambient	161	161	161.00	0.0	161	°C
T Stack	205	205	205.00	0.0	205	°C
T Preheat	N.A.		No Cal	No Cal	N.A.	°C
O2	21.9	21.9	21.90	0.0	21.9	%
CO	0	0	0.00	0.0	0	PPM
CO2	0.0	0.0	0.00	0.0	0.0	%
CxHy	4350	4350	4350.00	0.0	4350	PPM
Draft	N.A.		No Cal	No Cal	N.A.	KPA
Excess Air	OVER		No Cal	No Cal	OVER	%
NO	35	35	35.12	0.3	36	PPM
NO2	3	3	3.24	0.4	4	PPM
NOx	38	38	38.36	0.5	39	PPM
SO2	0	0	0.00	0.0	0	PPM
H2S	0	0	0.00	0.0	0	PPM
Velocity	5	5	6.07	0.6	7	MPS

h3w177e*

DELL

Boat Power Curve



Fish Harvesting Industry Ear Injury Rate / 10,000 Employees Newfoundland and Labrador 1997 - 2019

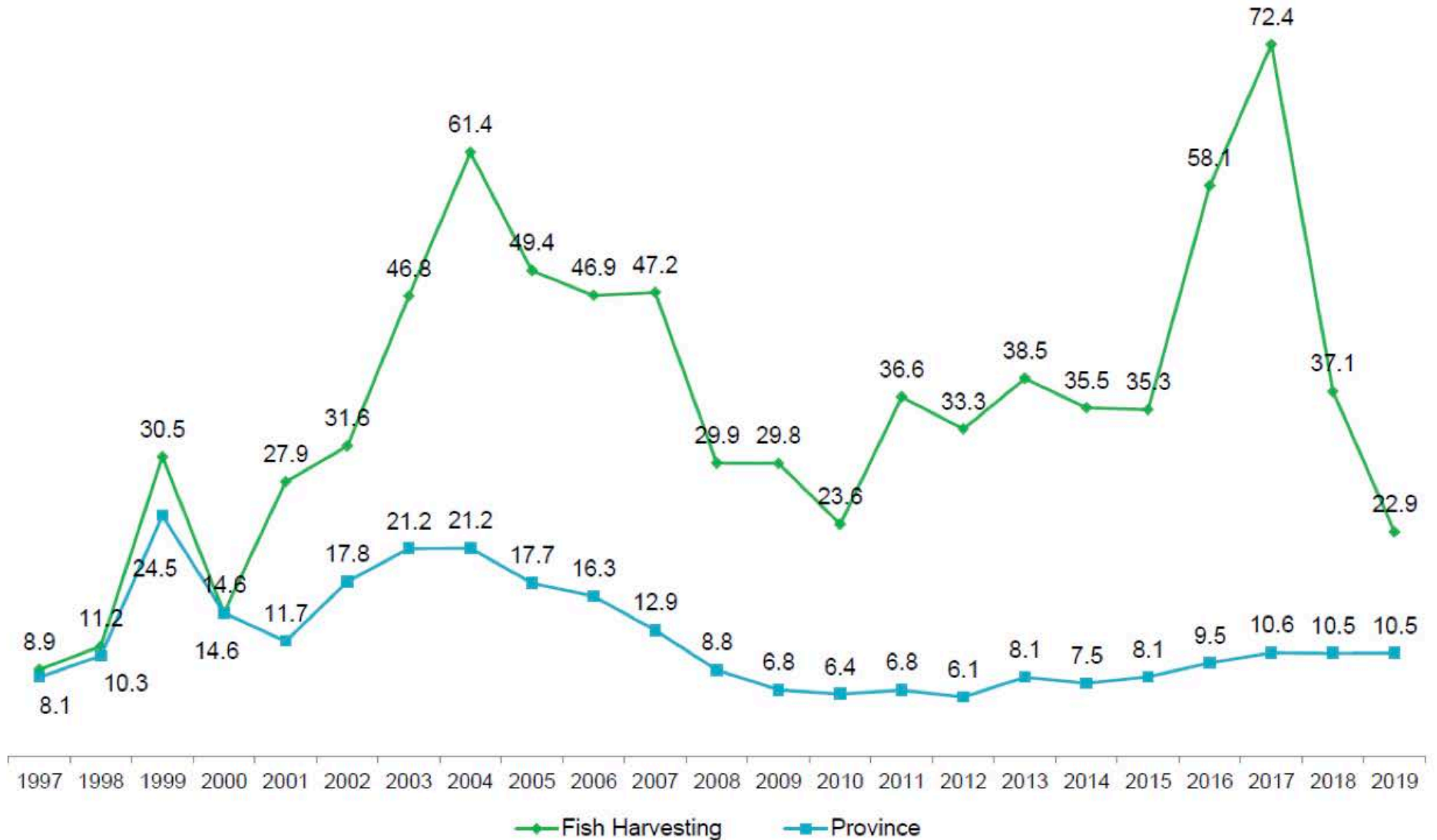
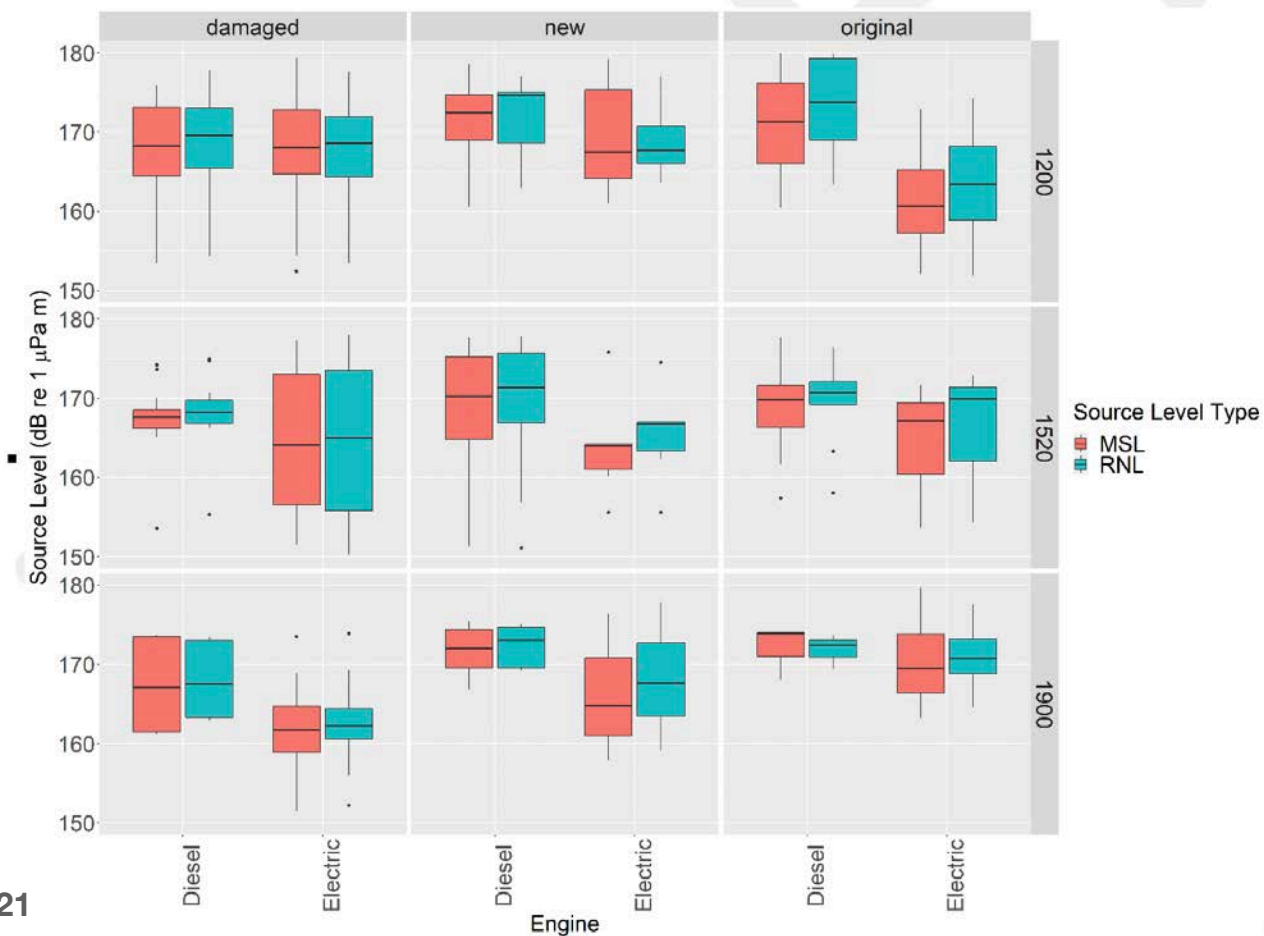


Table 11. Statistical summary of all accepted radiated noise level (RNL) and monopole source level (MSL) measurements presented in Figure 119.

Statistic	Engine	MSL (dB re 1 μ Pa m)	RNL (dB re 1 μ Pa m)
		79 Hz – 2 kHz	79 Hz – 2 kHz
Maximum	Diesel	194.6	193.5
	Electric	179.7	185.1
Upper quartile	Diesel	174.2	174.7
	Electric	171.1	172.4
Median	Diesel	169.7	169.9
	Electric	164.2	166.9
Lower quartile	Diesel	165.4	166.8
	Electric	159.4	161.9
Minimum	Diesel	145.8	146.3
	Electric	144.0	145.2



- Global fishing fleet 3.7M vessels
- 68% are motorised
- Over 2 million 20-500kW worldwide
- 1 million more boats expected by 2050

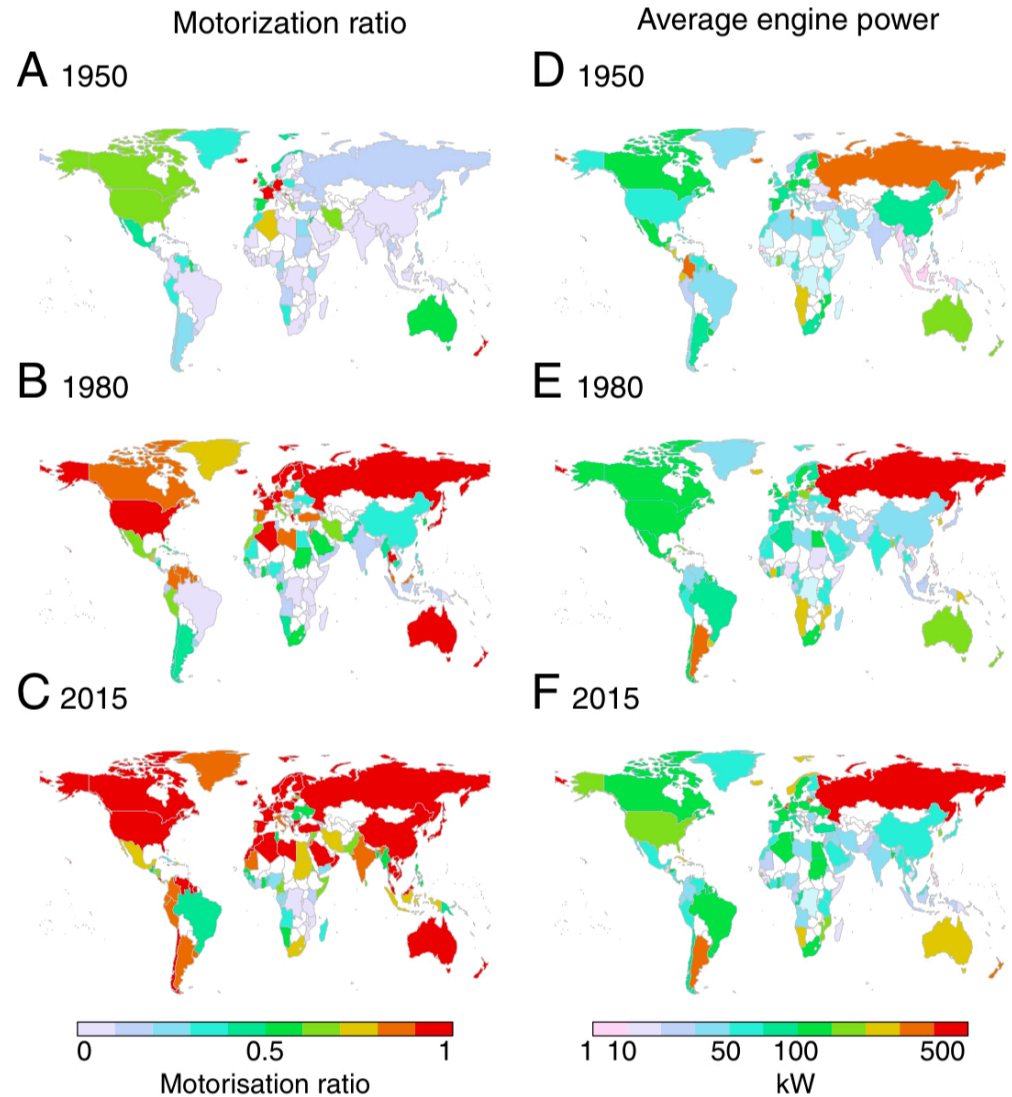
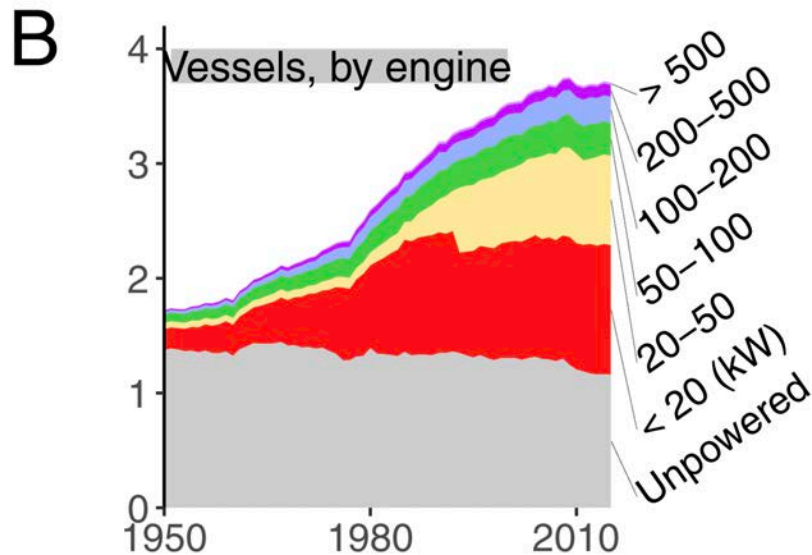


Fig. 2. Snapshots of the ratio of motorization (A–C) and average engine power in kilowatts (D–F) of the national motorized fishing fleet in 1950, 1980, and 2015, respectively. Motorization levels in European countries in 1950 might be overestimated due to the lack of data post-World War II. No data for the unmotorized fleet of Finland was found, but it was assumed that the motorization level was close to 100% since the 1970s, similar to other Scandinavian countries.



Thanks to Transport Canada, Province of Nova Scotia, and NRC for support of this work