

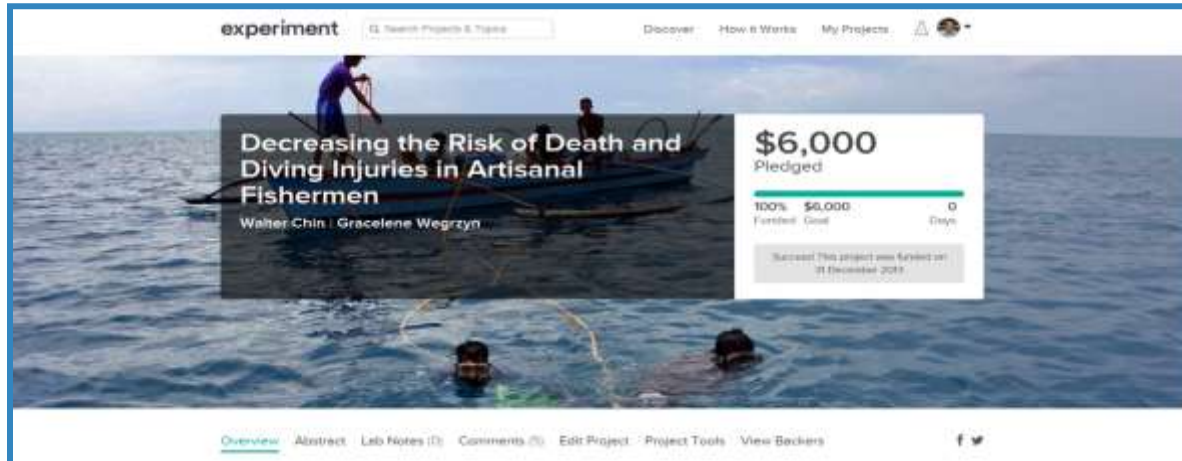
Reducing Carbon Monoxide Content in Surface-Supplied (Hookah) Air Sources of Artisanal Fishermen of the Yucatan Peninsula

June, 19 2014

Funding and IRB

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- UCLA Medical IRB-approved
 - IRB Number: 13-00532
- Microryza Crowd funding
 - \$6,000
- Oxyheal Health Group
 - \$1,600
- UCLA Health Care System
 - \$2,000



Budget



5 Dive Recorders, ULTRA SENSUS	\$1,180
Model Hookah Air Power Plant	\$725
Model Compressor	\$745
Model Volume Tank, 15 gallons	\$460
Model Filter System	\$350
Dive Umbilical	\$295
Carbon Monoxide test tubes	\$480
Carbon Dioxide test tubes	\$420
Carbon Monoxide Analyzer	\$345
Travel, Lodging, Facility, and Administration	\$1,000

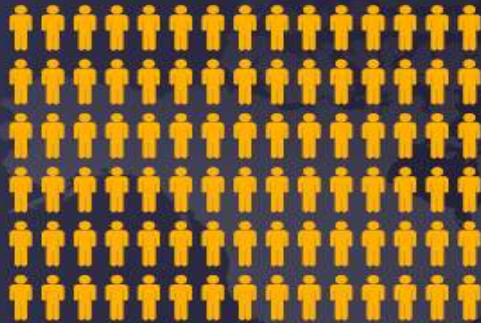


Local Communities Depend Upon Artisanal Fishing as a Source of Food and Livelihoods



90%
of Fishing Jobs
are Small-Scale

Of the estimated 26-29 million total fishing jobs in developing countries, approximately 25-27 million are in the small-scale fisheries sector.



90 Million
Related Jobs

Small-scale fisheries provide additional jobs in fish processing, distribution, and marketing.

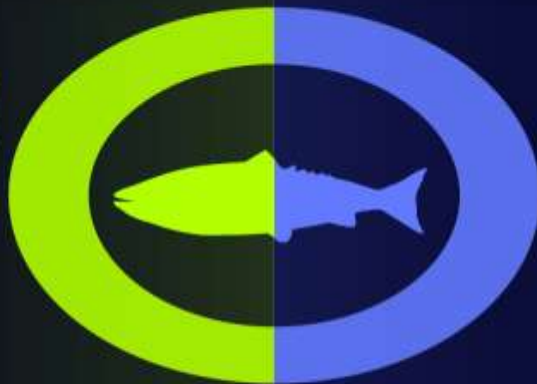


Small-Scale Yields Equal Large-Scale Industrial Yields for Direct Human Consumption

30

Million Tonnes

Small-Scale
Fisheries



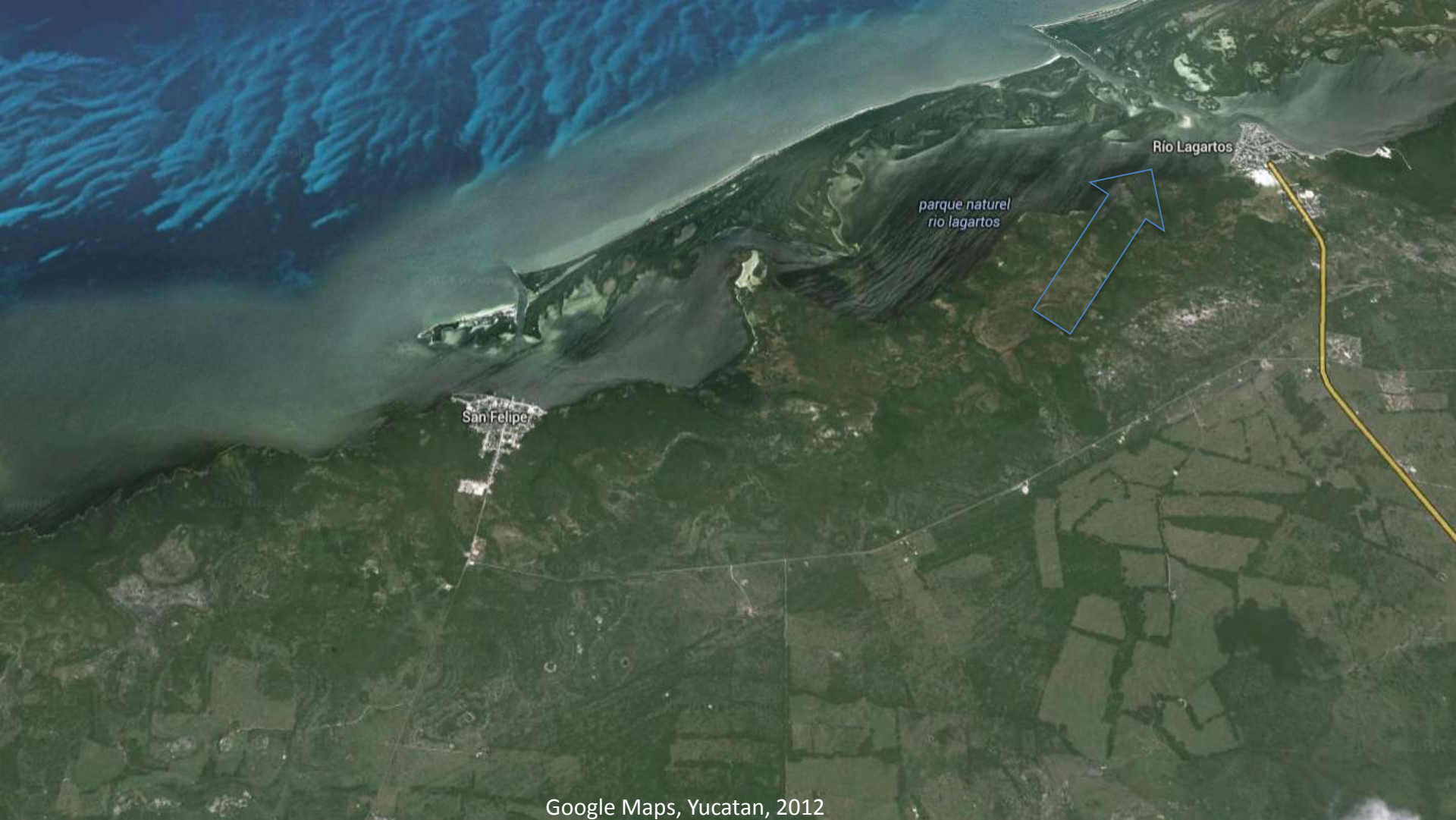
30

Million Tonnes

Large-Scale
Fisheries



Commercial fisheries catch an additional 35 million tonnes of fish for fishmeal, oils, etc



Rio Lagartos Fishing Cooperative

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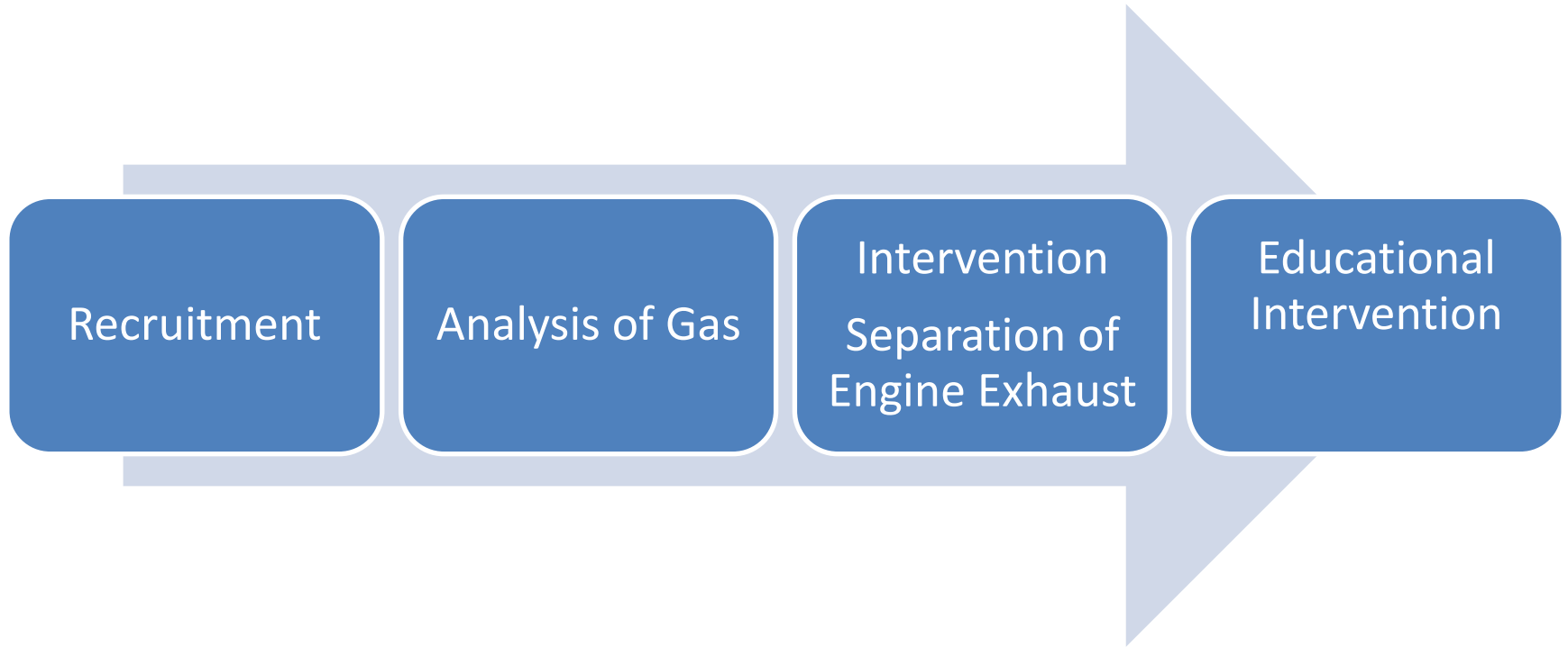


Problem Statement

1. Hookah systems compress contaminated gas into their supply.
2. Epidemic number of DCS cases per year.
3. Fishermen are resistant to change.
4. Cost (\$)
5. Equipment
6. Distance

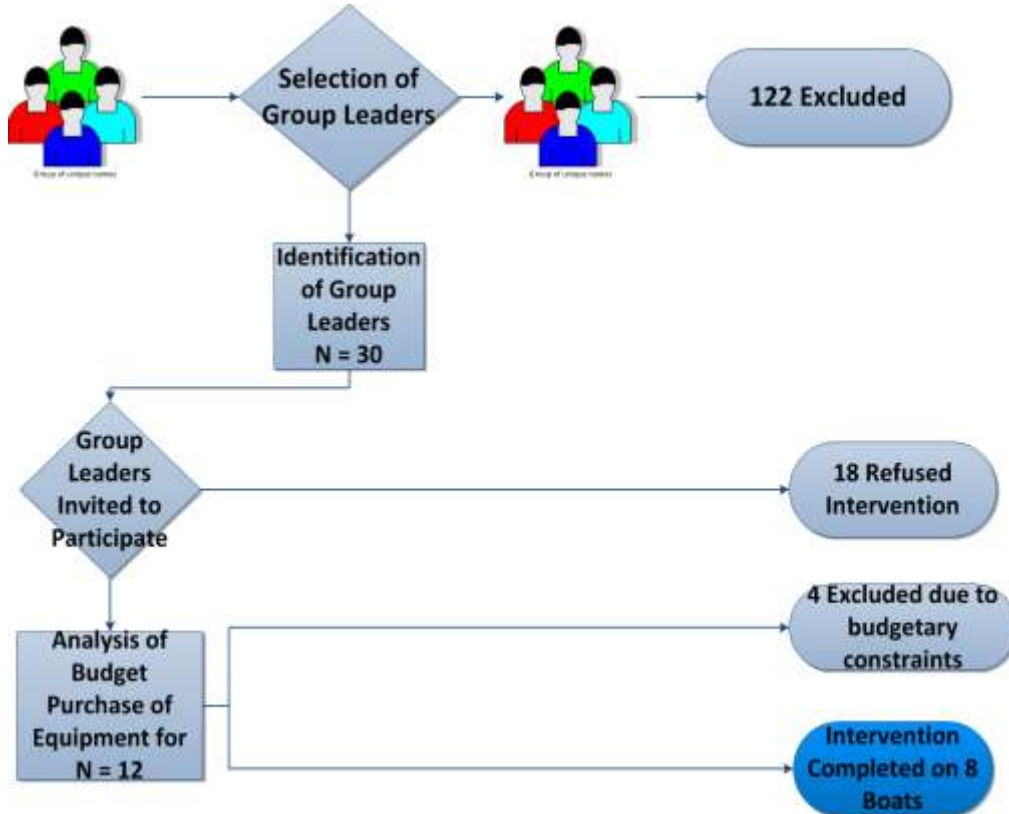


Study Design



Recruitment Methods

150





Materials: Gas Sample Manifold

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Materials: Gas Analysis



Square Analyzer CO
(± 1 ppm)

Galvanic Electro-chemical
90% Response time >::15

Materials: Gas Analysis



Calibration Gas
Carbon Monoxide

70 ppm CO Balance
($\pm 5\%$)

Materials: Gas Analysis



- Analox Aspida
 - CO₂
(±1ppm, ±2%)
- Calibrated
 - 09/01/2013

Materials: Gas Analysis



Visi-Float
Flowmeter ($\pm 5\%$)



Methods: Gas Analysis

1. HDS fills to full pressure
 - 100-160 PSI
2. Flush with O₂
 - 0.5 L/min for 15 sec
3. Turn 3-way valve to CO/CO₂
 - 0.2 L/min for 25 sec
 - Record CO/CO₂ (1)
 - Wait 10 sec
 - Record CO/CO₂ (2)



Methods: Gas Analysis

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4 CO and 4 CO₂
values were
attained from
each HDS
(N = 7)



Methods: Intervention







Educational Interventions

Posters

1. DCS signs and symptoms and CO and CO₂ poisoning warning
2. Administration of medical O₂
3. Intervention “How-To” guide



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CUIDADO

Evitar el uso de
Montaje



UCLA INSTRUCCIONES PARA EL USO DEL TANQUE DE OXIGENO

Únase al grupo **UCLA** y **exclusivamente** para el traslado de personas con posible enfermedad por neumocefalia para recibir atención médica y tratamiento en una Cámara Hiperbárica.

PROCEDIMIENTO



Se prohíben fumar y explosivos - Realice un chequeo antes del Oxígeno



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Riesgo de Envenenamiento

La experiencia después de la
Baja de Cabeza - Miedo/Ansiedad
Alto Nivel de Dificultad
Pérdida de la Conciencia
Puede ser consecuencia del uso

10 Pasos para mejorar la calidad





Riesgo de Envenenamiento por Monóxido de Carbono- Protégete!

¿Ha experimentado después de bucear?:

Dolor de Cabeza Náusea/Vómito Mareo Debilidad

Visión Borrosa **Dificultad para Respirar**

Pérdida de la Conciencia

¿Podría tener serenosamiento del monóxido de carbono?

10 Pasos para mejorar la calidad del aire.



El monóxido de carbono es un gas tóxico producto de los motores de combustión. Desplaza al oxígeno en la sangre y causa daño al corazón, pulmones y cerebro.

• Para prevenir el envenenamiento coloca en tu compresor una manguera de 1.5 metros con filtros especiales.

Esta intervención puede reducir el monóxido de carbono a menos de la mitad.

• Si presentas síntomas de envenenamiento, respira aire fresco y busca atención médica.



Educational Interventions

Collaborative Presentation

- Intervention effectiveness in participants (Huchim)
- Demonstration of O₂ administration
- Medical O₂ tank gifts



Statistical Analysis: Testing for Differences

SPSS

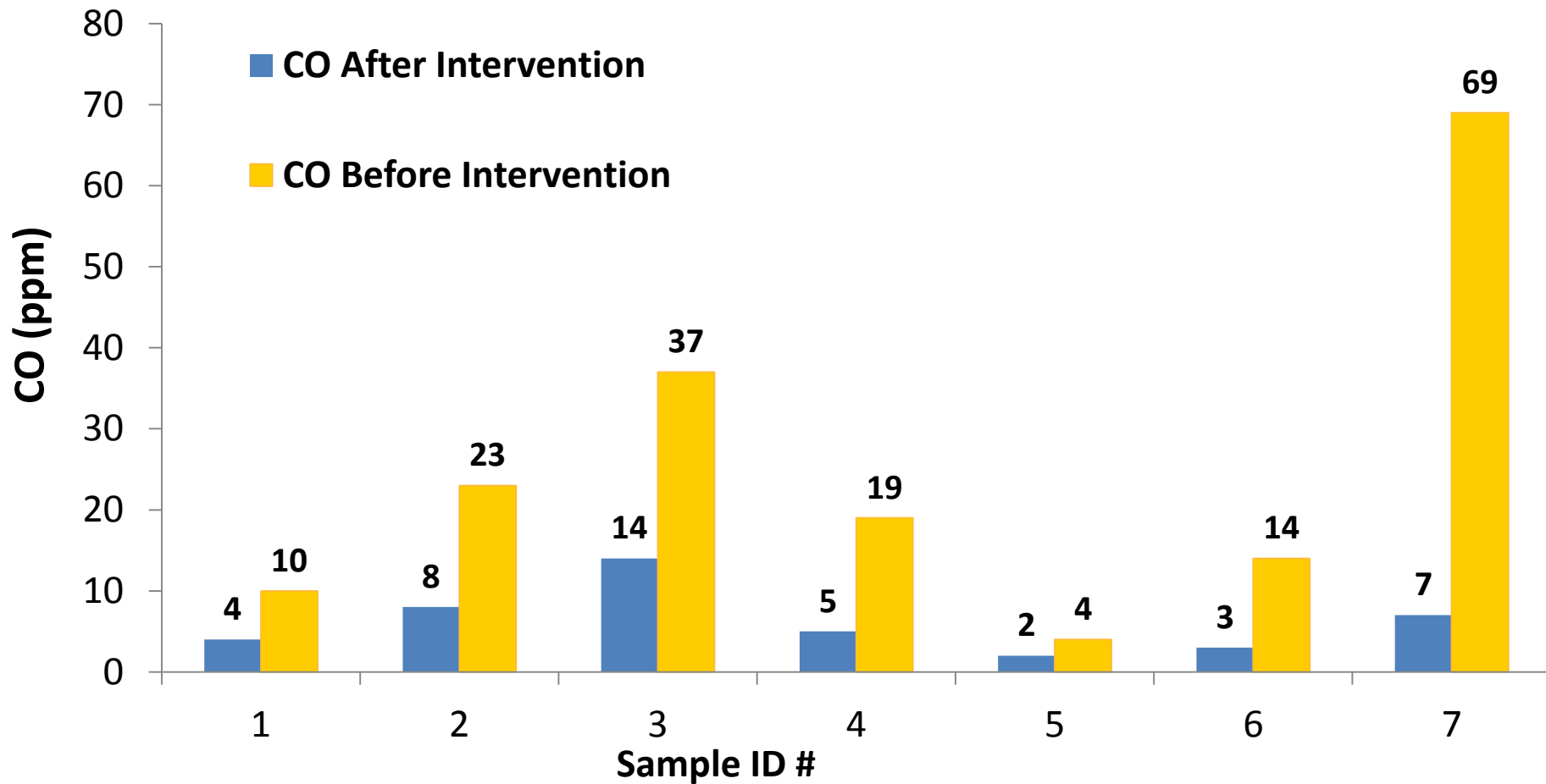
- Mean, median, and range of CO and CO₂ levels
- Normal distribution
- Paired samples *t*-test

Results: Mean Differences

Gas	Pre- Intervention (N = 7)		Post- Intervention (N= 7)		Mean Differences (df = 6)	
	Mean (ppm)	Range (ppm)	Mean (ppm)	Range (ppm)	<i>t</i>	<i>p</i>
CO	25.5	4.0-68.0	7.0	2.0-17.0	2.62	0.04
CO ₂	430	400-500	400	400	2.07	0.084

CO Analysis

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Cost Analysis

Material	Cost (USD)
Heat-resistant Polyethylene Hose (7")	\$10.00
Aluminum Plate (0.25 X 4.00" X 1.75")	\$20.00
Misc. Spare Parts (Clamps, twist ties, etc.)	\$10.00
TOTAL Cost of Intervention	\$40.00

Conclusion

- The intervention reduced CO in the fishermen's air supply by 75% to acceptable diving levels
- CO₂ levels do not appear to be at detrimental levels to these divers

Discussion

- This intervention could be applied to additional members of the fishing cooperative.



Thanks for Listening

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