

Benefits, Particularly to Furred and Feathered Wildlife, of the Use of Biodegradable, Particulate Sorbent in Spill Response

This presentation evaluates the use of applying biodegradable absorbing material to contain petroleum spills and to reduce exposure to plants, animals, and soils.

The benefits, particularly to furred and feathered wildlife, of the use of biodegradable, particulate sorbent in spill response

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Project: SSEP P0775005

Jack Ames, OSPR, DFG, Santa Cruz

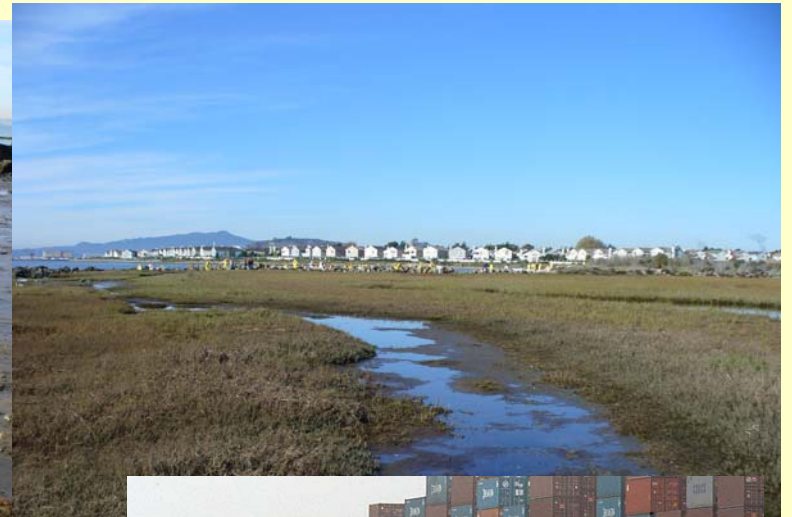
Jim Hardwick, retired

Randy Imai, OSPR, DFG, Sacramento

Susan Sugarman, OSPR, DFG, Folsom



Chronicle / Michael Macor



Cosco Busan, November 7, 2007



Chronicle / Frederic Larson

Study Objectives:

Evaluate a strategy for petroleum spill containment based on application of biodegradable absorbing material to reduce exposure to plants, animals, and soils.

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How feasible and effective is the method?

Method:

Environmental Substrates--

- a) marsh vegetation *Salicornia virginica* (pickleweed)
- b) sand
- c) open fresh water

Petroleum Contaminates--

- 1) Prudhoe Bay crude oil (**PBC**)
- 2) Diesel fuel oil #2

Treatment--

Sphag Sorb, peat moss dust particulate

aerator
tube



Pickleweed Tanks

Perlite
still
visible
2 weeks
after
planting



float-
valve
and
pump



Pickleweed 7 weeks planting, low and high density canopy on left and right

*Sorbent protected pickleweed from **Prudhoe Bay Crude Oil***



After application:
treated on left and untreated on right



After 2 weeks:
treated low density canopy



After two weeks:
damaged untreated in foreground.



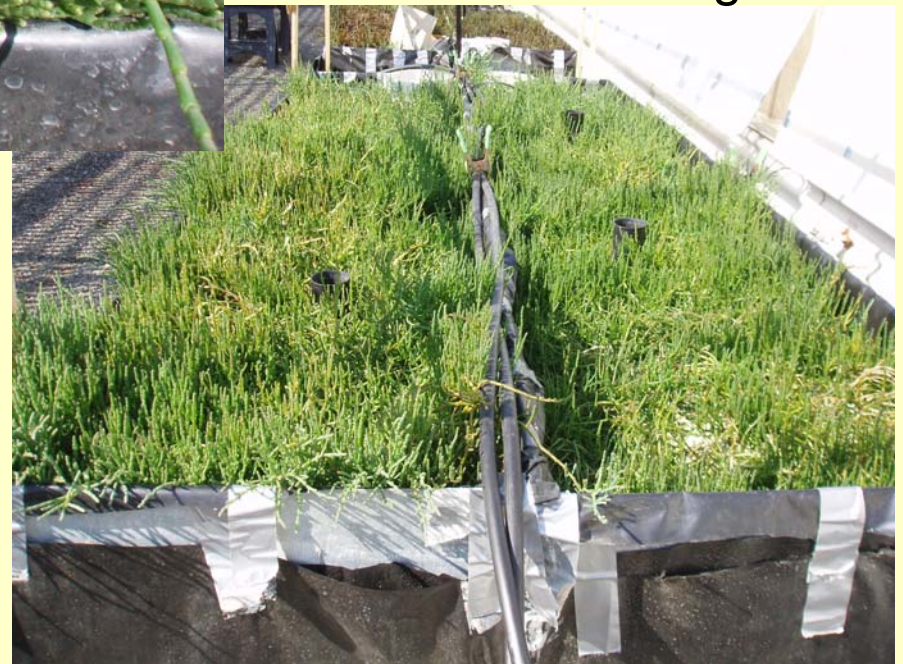
After 4 weeks:
damage untreated in foreground

No effect of ***Diesel Oil***
on *Pickleweed*



After application:
treated on left and untreated on right

After 2 weeks:
untreated in foreground



PBC application: Sorbent on left and No Sorbent on right



Sorbent pulls oils from sand



Diesel oil application: Sorbent on left and No Sorbent on right

SORBENT ABSORBS OIL on WATER



After **PBC** application: Sorbent on left and No Sorbent on right



After **diesel** oil application: Sorbent on left and No Sorbent on right

Method:

Oil stickiness by **Weight Accumulated** to wipers:

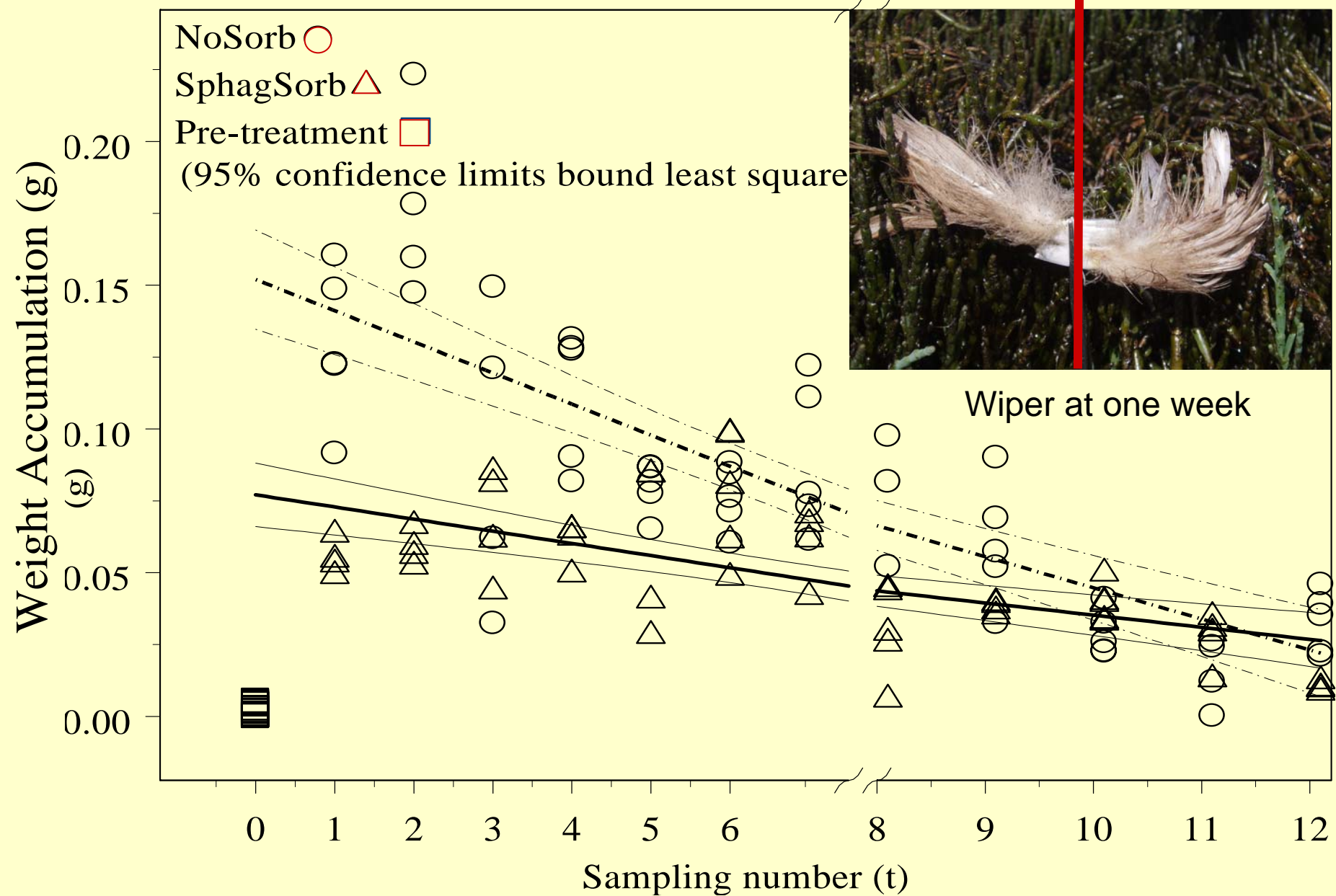
- **Feathers** – goose, 3" jigs
- **Fur** – sheep wool sheering, 0.5" nap, 1.5" pads
- **Polypropylene cloth** – short nap, 1.5" patches
- **Filter paper** – Waltman #2,
Not presented

Five wipes with each type:
t00 Background wipe
t01 – t07-- First week:
day 1 through 7

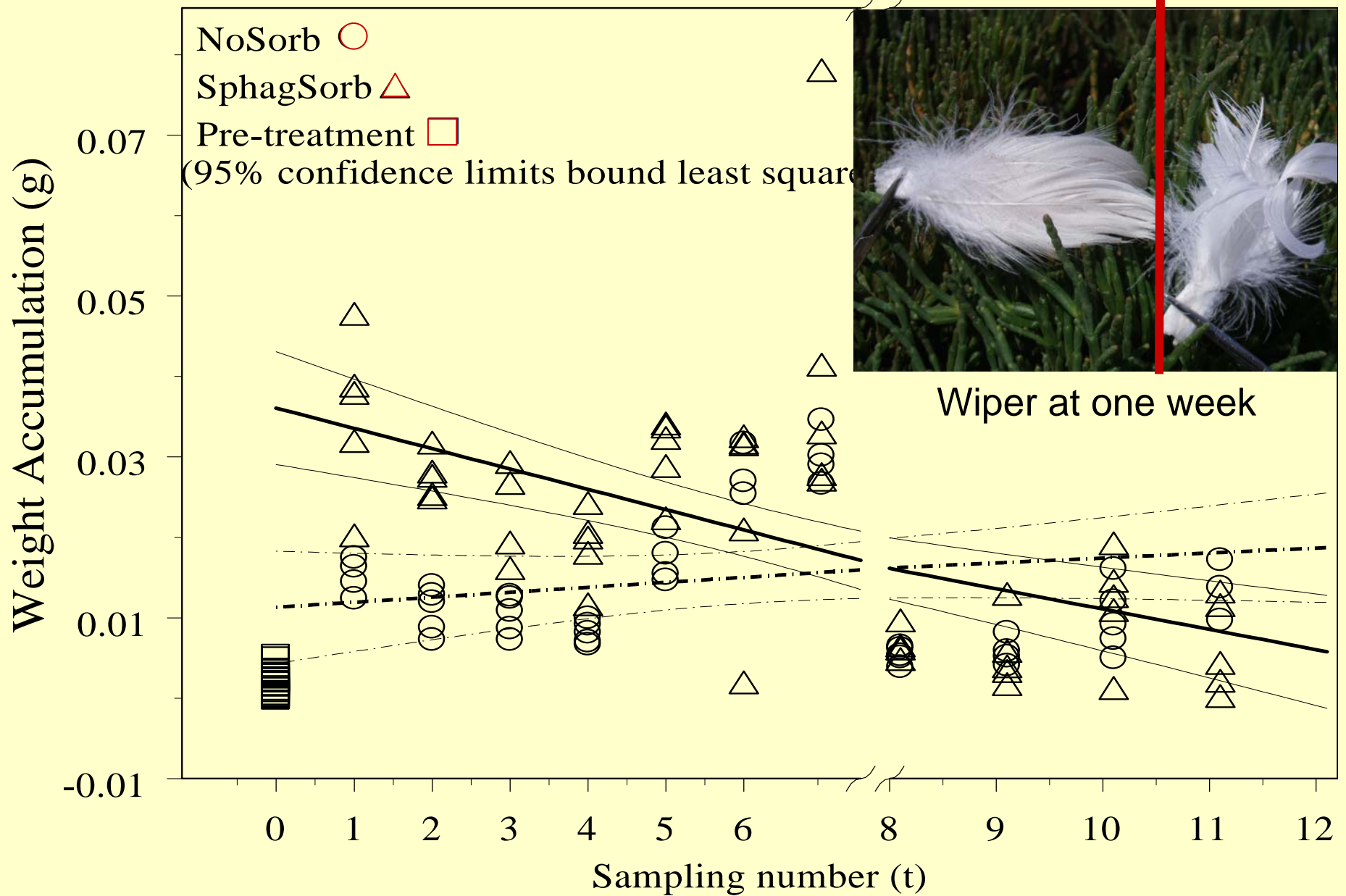


t08, t09, t10-- Weekly:
day 14, 21, and 28
t11 and t12-- Monthly:
day 35 and 62

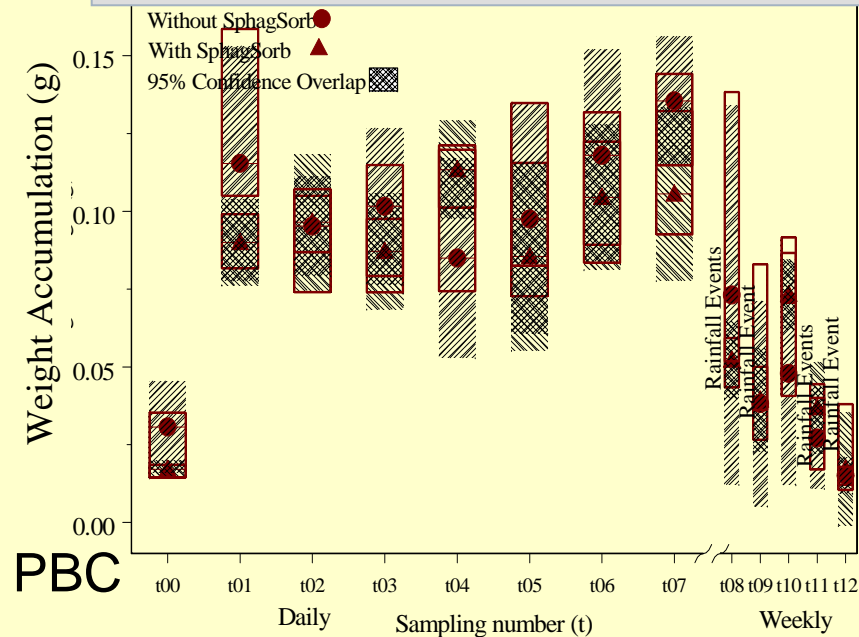
PBC on Pickleweed, Feathers: Sorbent Treated vs. Untreated



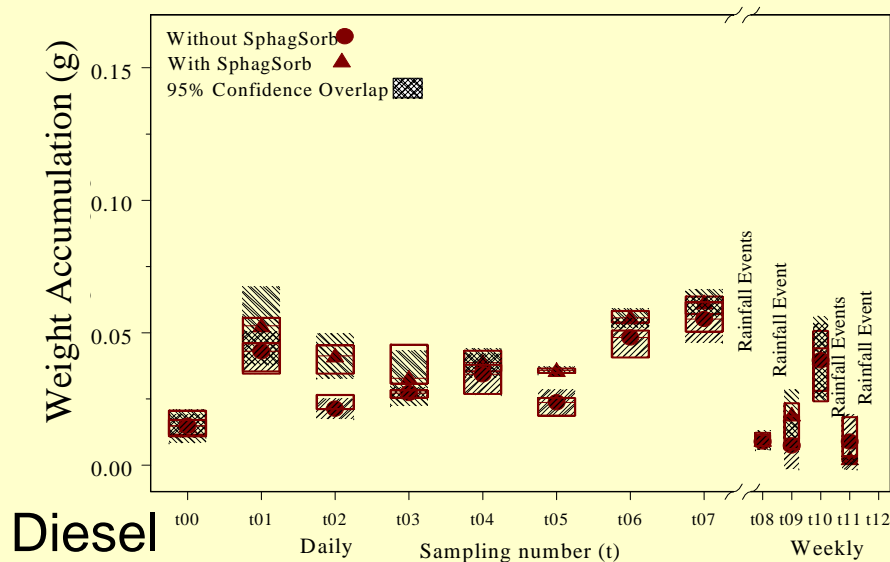
Diesel on Pickleweed, Feathers: Sorbent Treated vs. Untreated



PBC and Diesel on Pickleweed, Fur: Sorbent Treated vs. Untreated

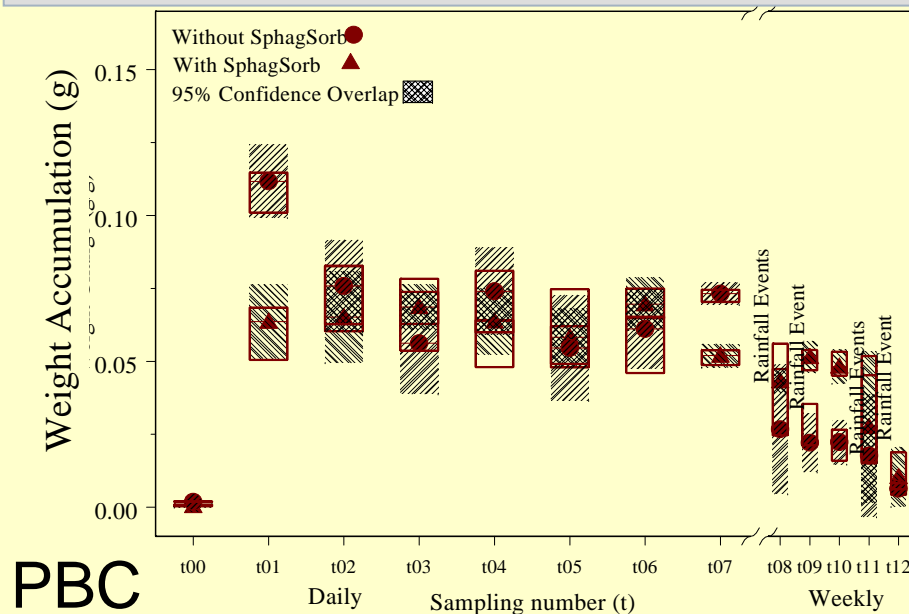


PBC: Wiper at one week

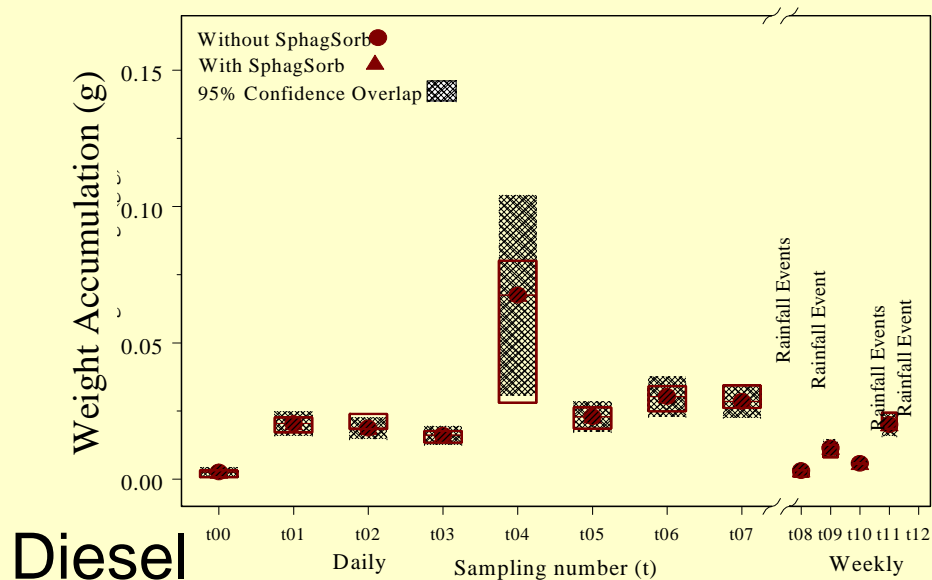


Diesel: Wiper at one week

PBC and Diesel Oils on Pickleweed, Polypropylene: Sorbent Treated vs. Untreated

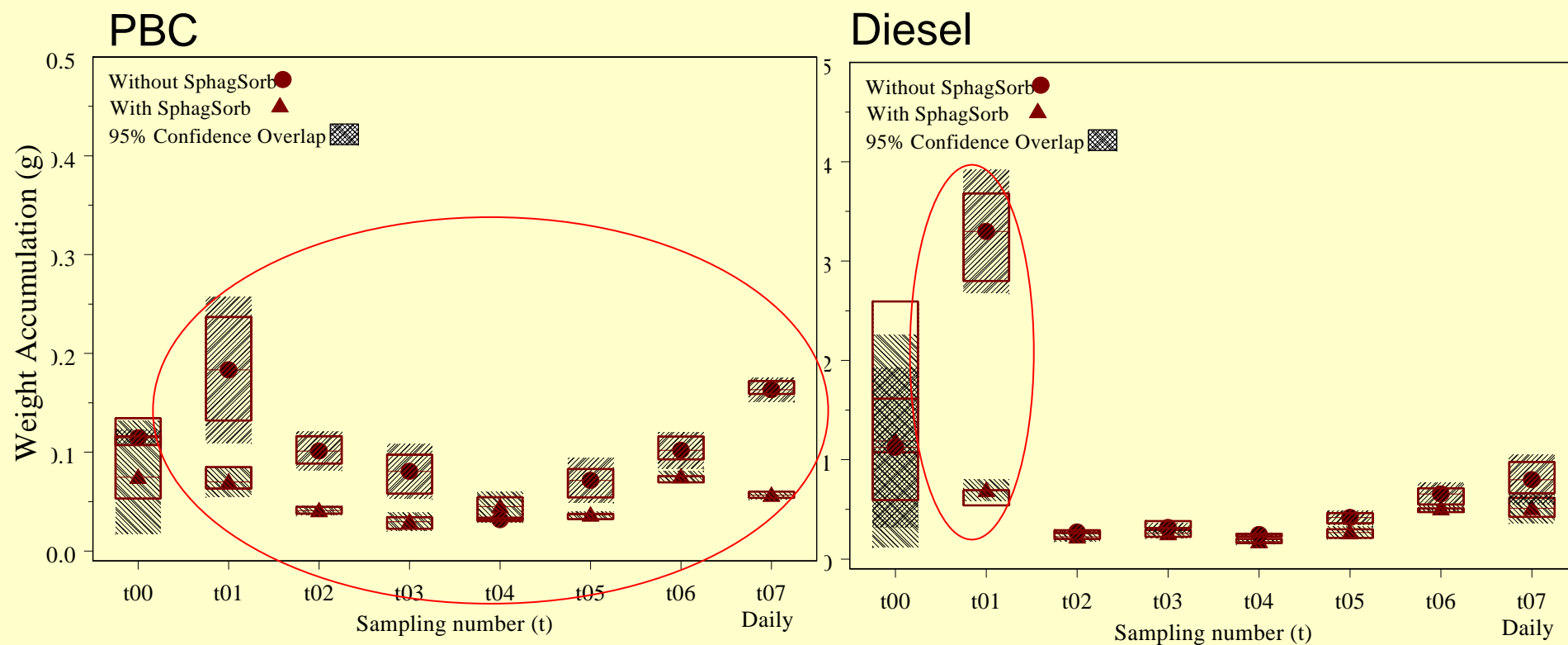


PBC: Wiper at one week



Diesel: Wiper at one week

PBC and Diesel Oils on Sand, Fur: Sorbent Treated vs. Untreated

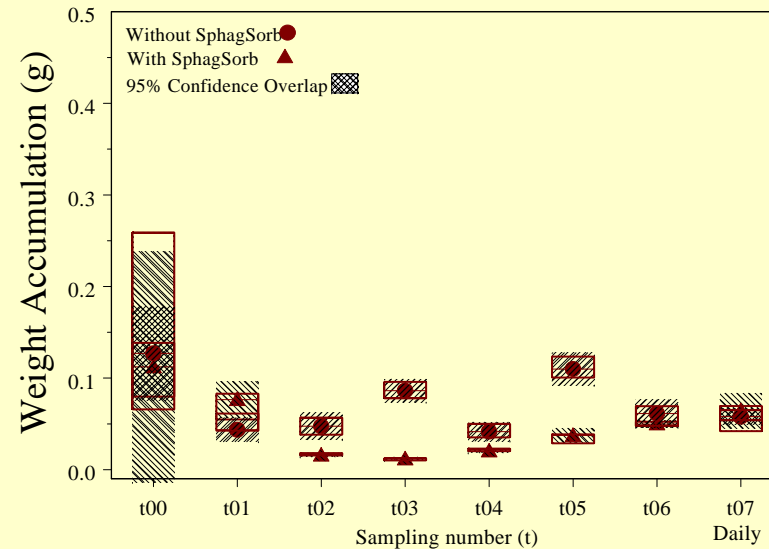
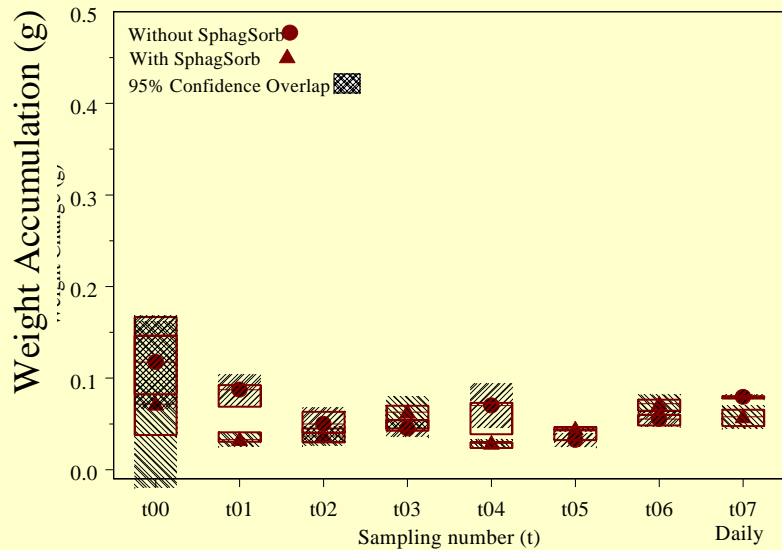


Sand, PBC and Diesel– Sorbent Treated vs. Untreated

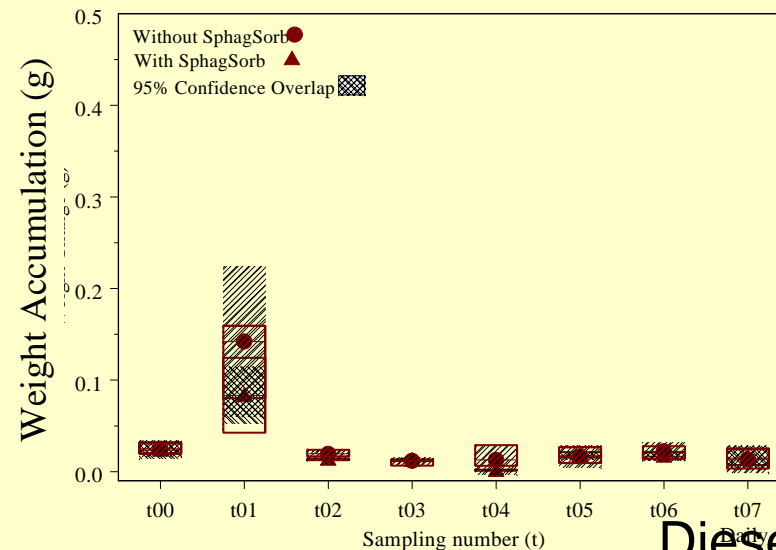
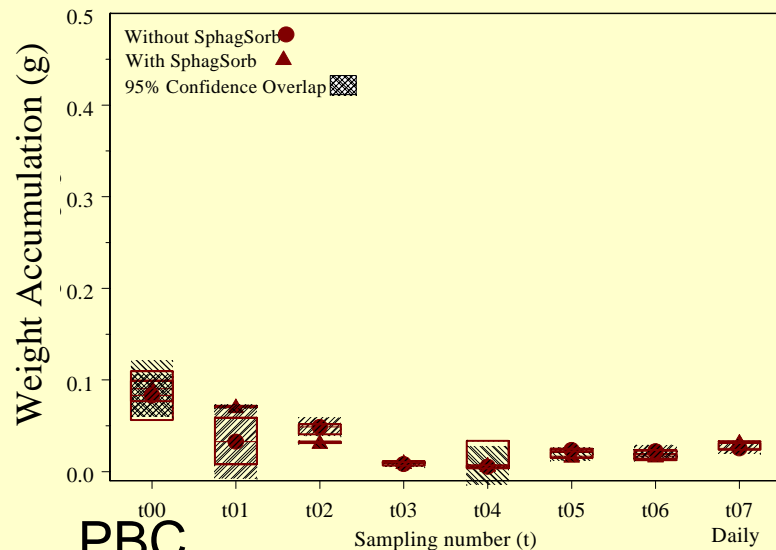
PBC

Feathers

Diesel

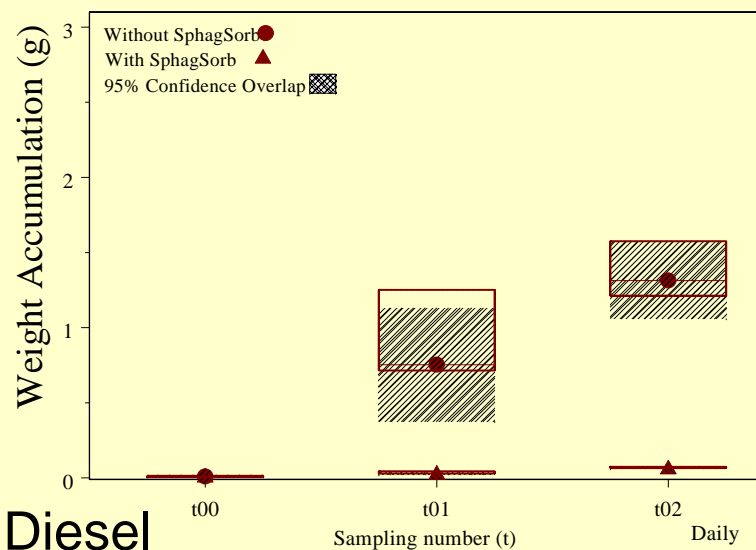
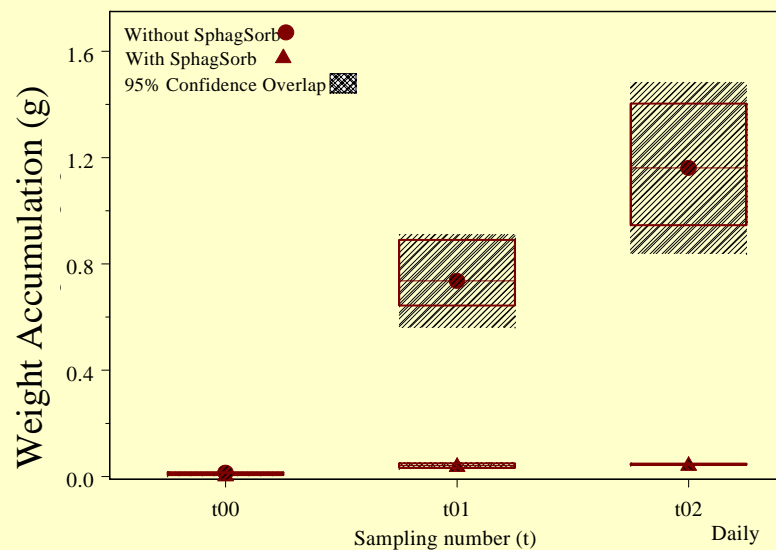


Polypropylene



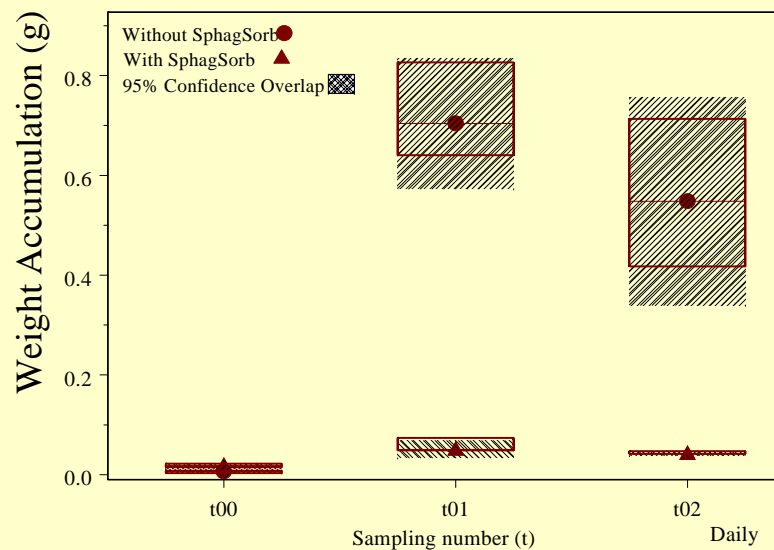
Water, PBC and Diesel, Feather: Sorbent Treated vs. Untreated

PBC

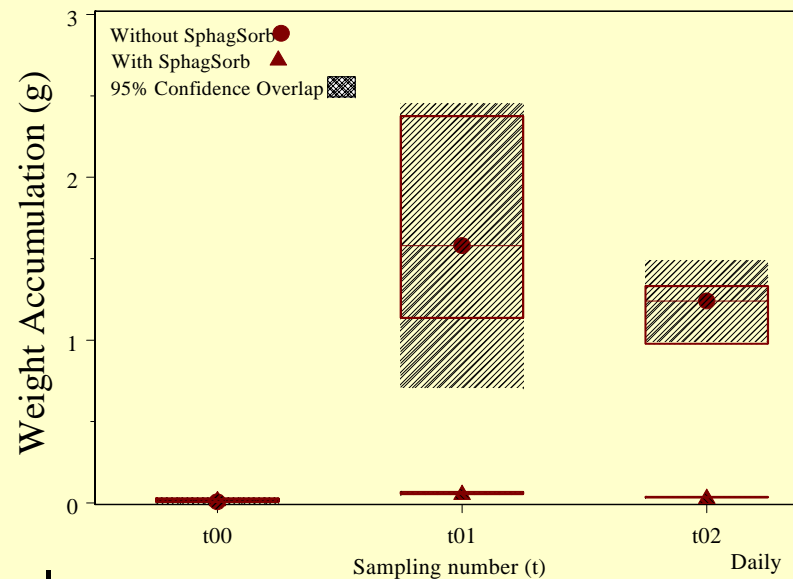


Water, PBC and Diesel—Sorbent Treated vs. Untreated

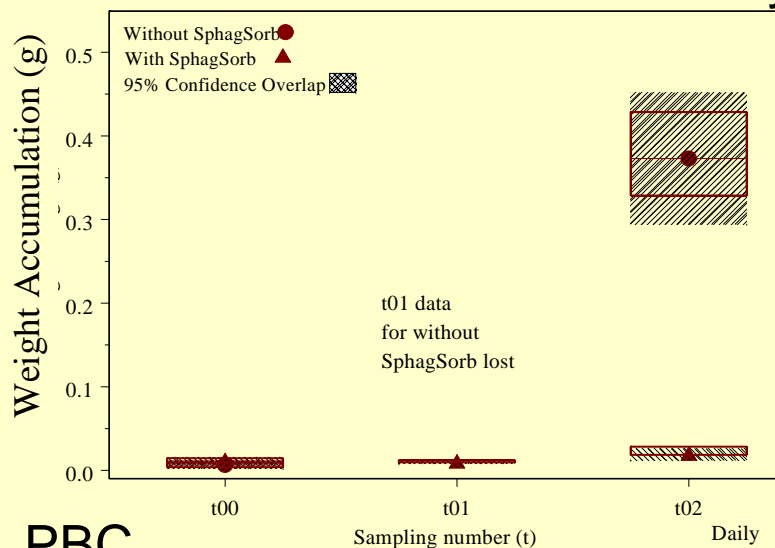
PBC



Fur

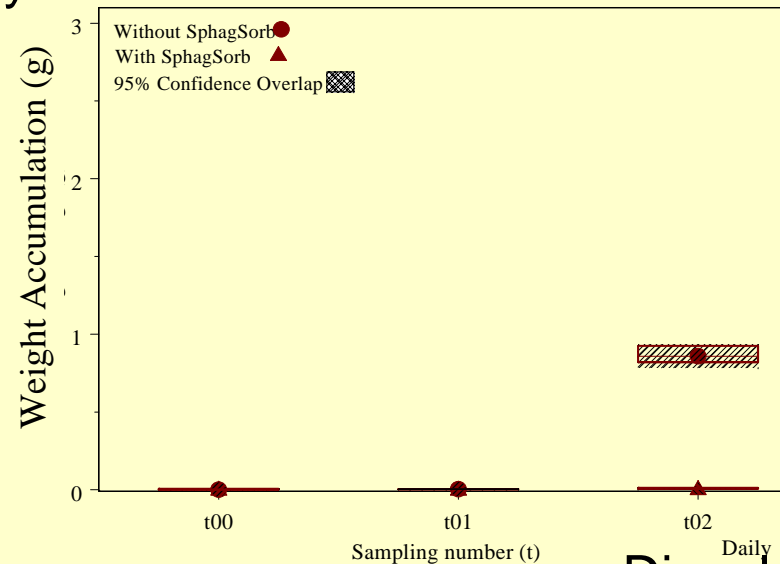


Diesel



PBC

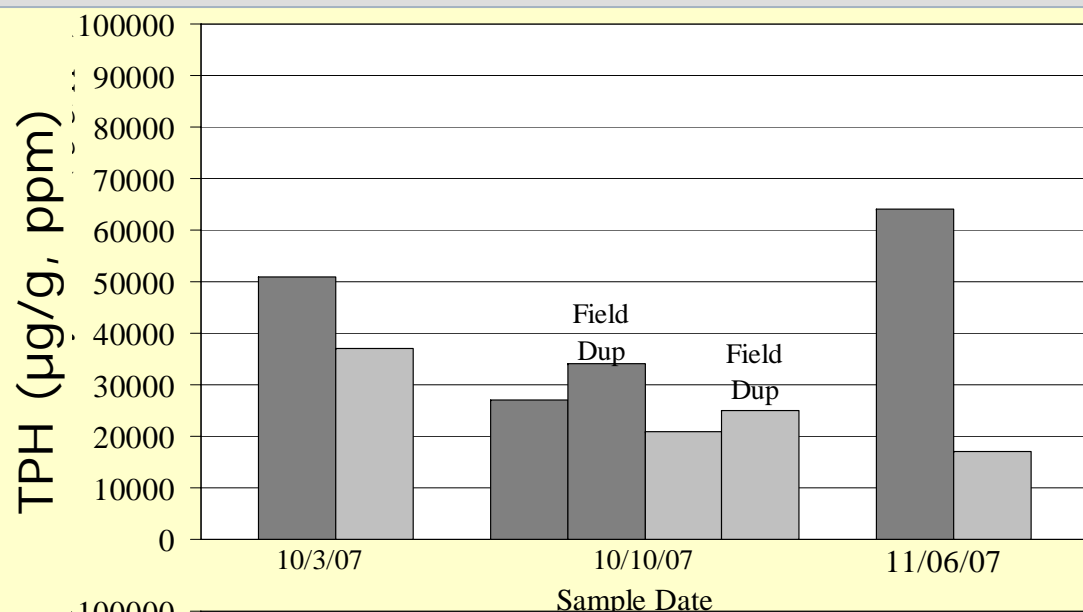
Polypropylene



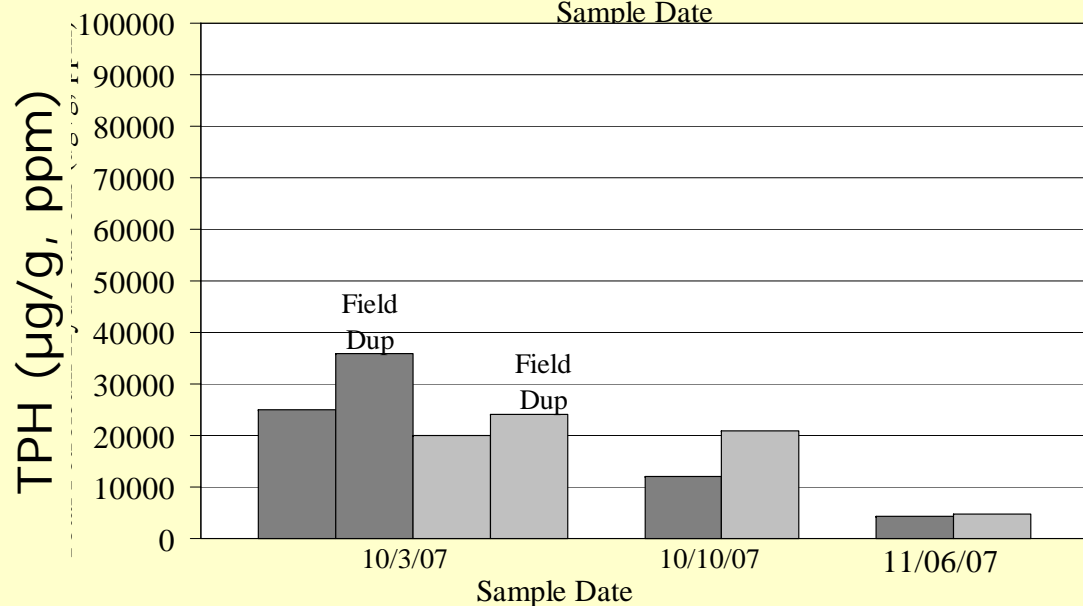
Diesel

PICKLEWEED: TOTAL PETROLEUM HYDROCARBON CONCENTRATION

24 HRS, 1 WEEK, 1 MONTH AFTER APPLICATION



Prudhoe Bay crude oil
 Sorbent treated-- light bars
 No Sorbent-- dark bars

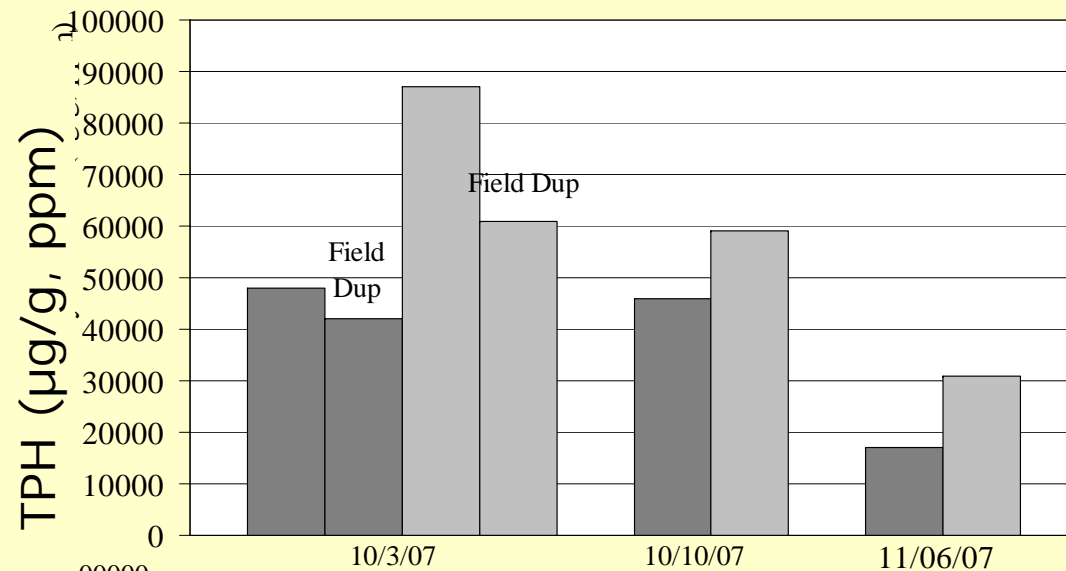


Diesel oil
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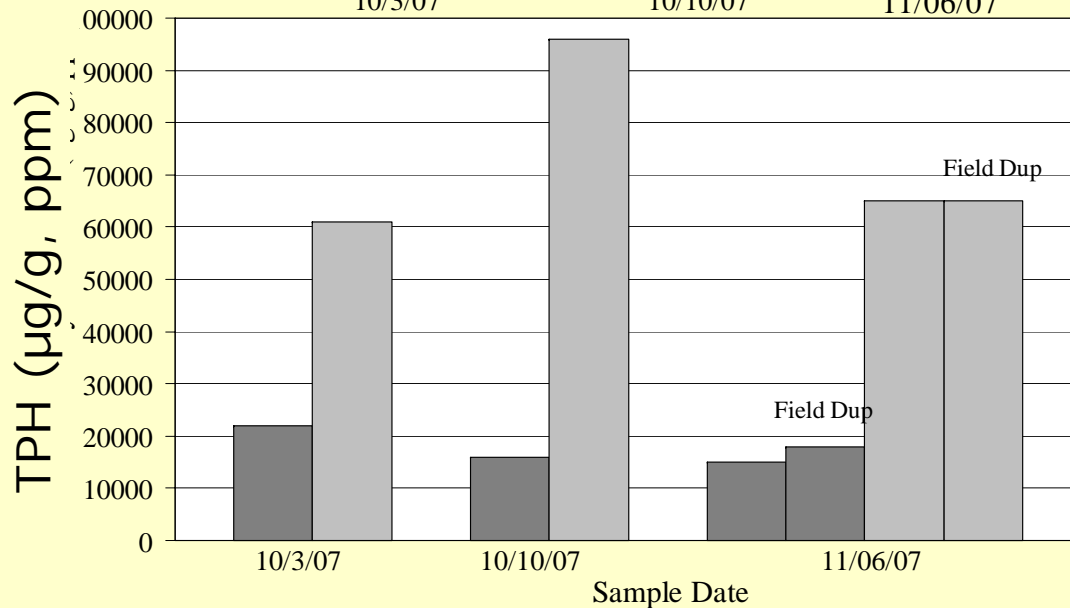
Background hydrocarbons

	Pickleweed
TPH (ug/g)	97 - 970

SAND: TOTAL PETROLEUM HYDROCARBON CONCENTRATION 24 HRS, 1 WEEK, 1 MONTH AFTER APPLICATION



Prudhoe Bay crude oil
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No Sorbent-- dark bars

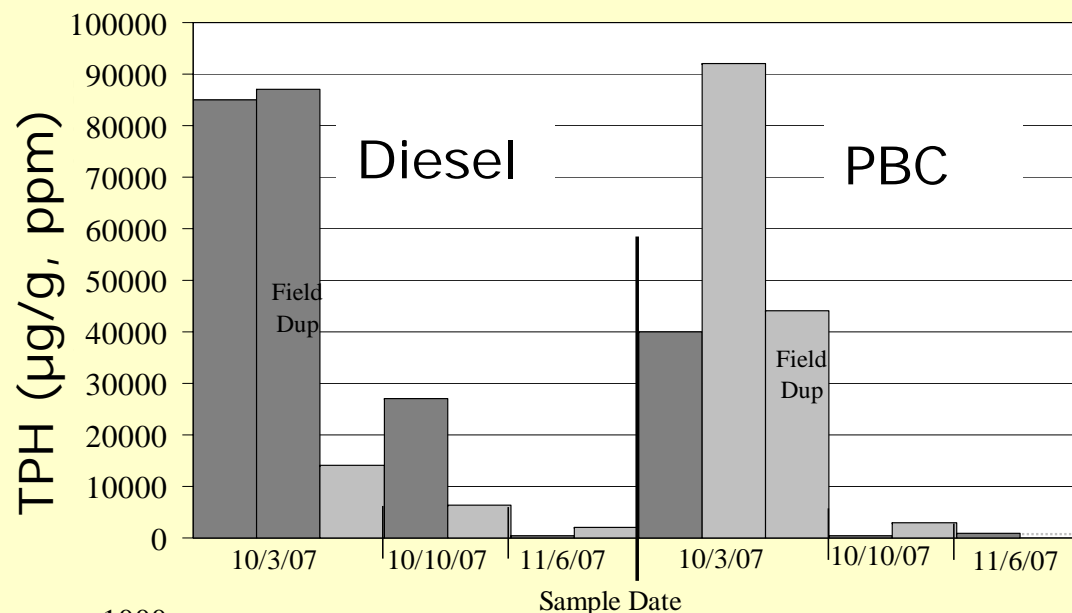


Diesel oil
Sorbent treated-- light bars
No Sorbent-- dark bars

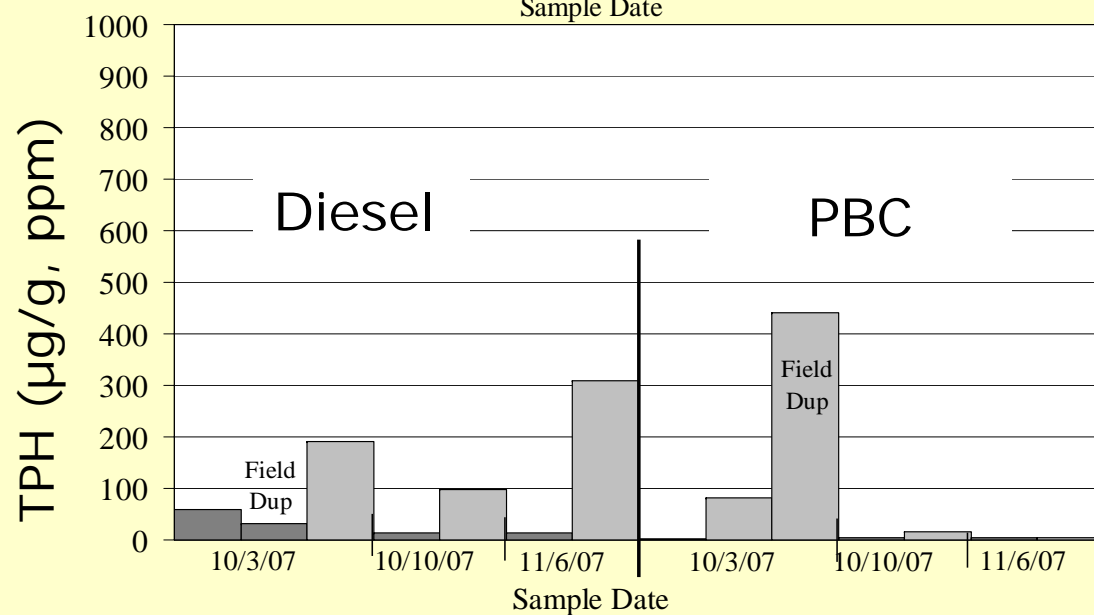
Background hydrocarbons

	Sand
TPH (ug/g,ppm)	<20 - 63

WATER: TOTAL PETROLEUM HYDROCARBON CONCENTRATION (TPH) 24 HRS, 1 WEEK, 1 MONTH AFTER APPLICATION



SURFACE water
PBC and Diesel oil
Sorbent treated-- light bars
No Sorbent-- dark bars



SUBSURFACE water
PBC and Diesel oil
Sorbent treated-- light bars
No Sorbent-- dark bars

Background hydrocarbons

	Surface	Subsurface
TPH (ug/g)	0.26 - 0.66	0.23 - 0.57

Discussion

Hypothesis A: Applying sorbent to petroleum-contaminated substrates will immediately render it less sticky to fur and feathers.



Yes, immediately and for several days after.

Feathers in pickleweed and water

Fur in sand and water

Did not determine a reliable substitute for feather and fur.

Discussion

Hypothesis B:
Petroleum of different
molecular weights have
different adherence to
feathers and fur.



Yes, Crude is absorbed substantially and significantly greater than diesel.

Diesel evaporates quickly, little or no residues.

Discussion

Feasibility Study: Statistical Evaluation of Design for Pickleweed and PBC

Number of observations needed based on
variance

- Feather--**2** wipes, five wipes sensitive to **0.024 g**
- Fur--**29** to **39** wipes, needed sensitive **0.07 g**

Conclusions

For crude oil spills, peat sorbent will:

1. reduced the damage to plants
2. significantly reduced the stickiness
3. absorbed crude oil preferentially to water for screening the oil from the water surface.
4. greater absorption than sand



Conclusions

For diesel oil spills, peat
held oil from evaporating:

1. absorbed diesel oil
preferentially to water for
extracting the oil from
water surface.
2. may increase diesel oil
persistence in marsh
system



Needed: Application protocols with regard to toxicity and timing.

Toxicity: Sorbents **may** decrease birds and animals exposure and reduce ingested.



Without oil, water saturated
Sphag Sorb sinks to bottom.



Before and after rubbing tar
covered with Sphag Sorb

Cosco Busan Spill, Richmond cleanup site,
November 14, 2007

Timing: Volatile components are important for
sorbent absorption of crude oil.