

Evaluating Drifter and Drogue Lifetimes

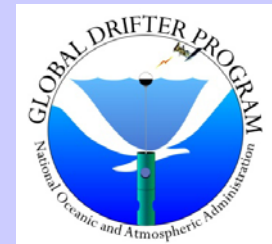
Presenter:
Erik Valdes

Collaborators:
Rick Lumpkin, Mayra Pazos, Shaun Dolk

Drifter Data Assembly Center
(GDP/DAC)



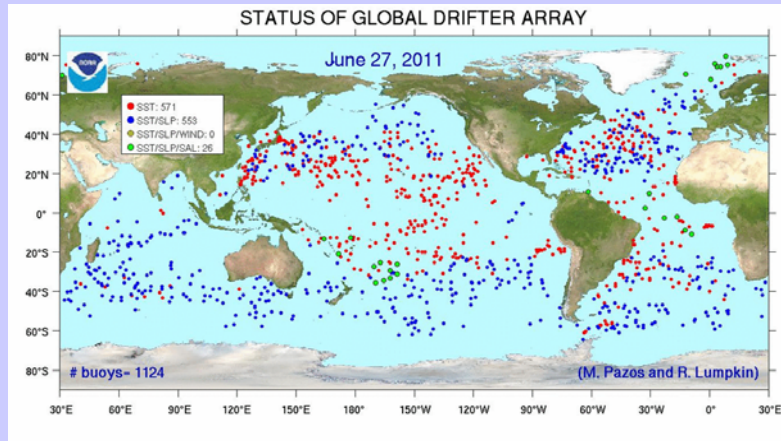
NOAA/AOML
Miami, Florida



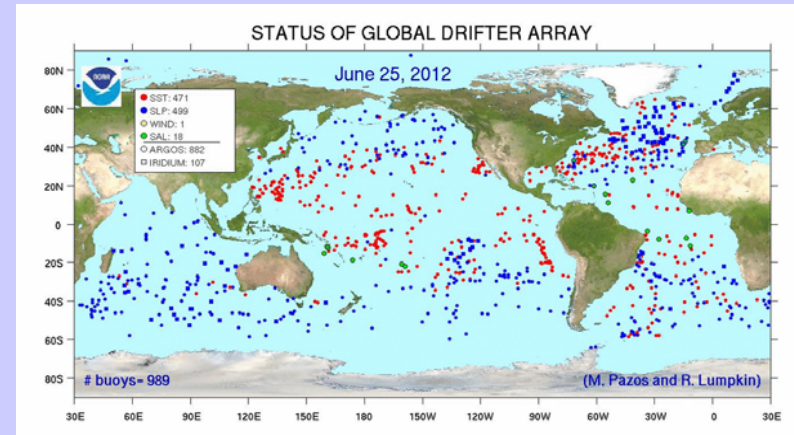
DBCP-29, September 23-27, 2013

Paris, France

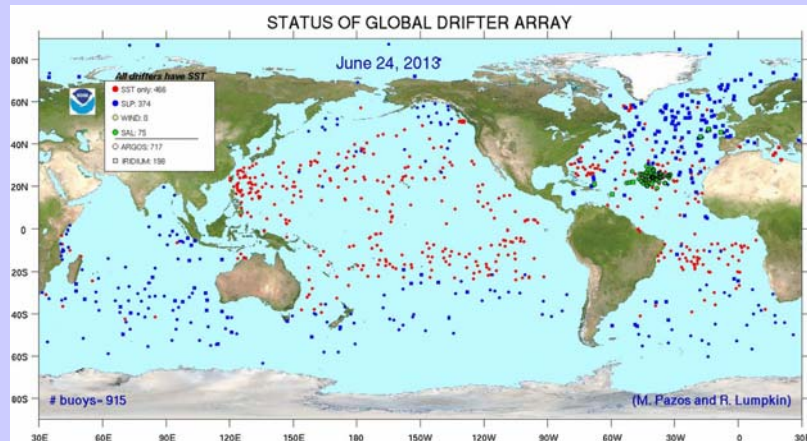
How has the array size evolved?



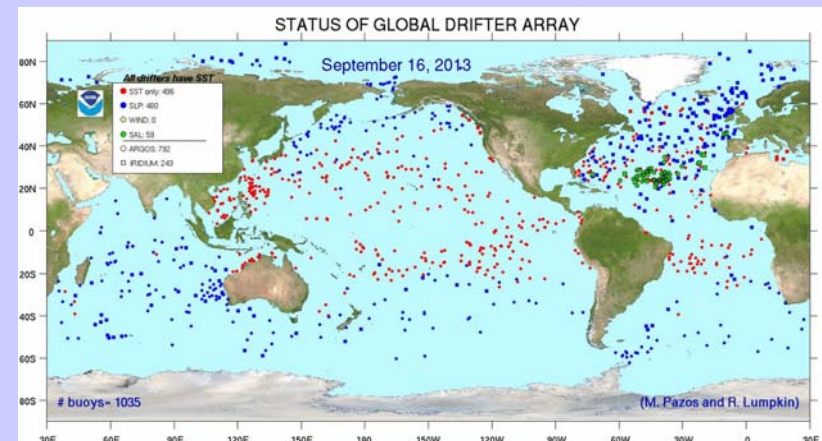
June 27, 2011
Drifters: 1124



June 25, 2012
Drifters: 989



June 24, 2013
#Drifters: 915



Sep 16, 2013
#Drifters 1035

A historical look at drifter deaths

Use directory file (QC data) for 1 Jan 2005—30 June 2013.

Use deployment log to include *Failed on Deployment* drifters.

We are now including DBi and SIO drifters for this analysis.

Do not use “manufactured on” date: we only have this information for 31% of the drifters deployed since 2005.

(10% of Clearwater, 85% of Technocean, 6% of Metocean, 5% of Pacific Gyre, 5% of Marlin-Yug, 99% of DBi, 99% of SIO).
Instead use “deployed on” date or “died on” date.

Half-life calculations

The half-life tells us how long it takes for 50% to die. Unlike mean lifetime, which can't be calculated until ALL are dead, we can calculate this once half are dead.

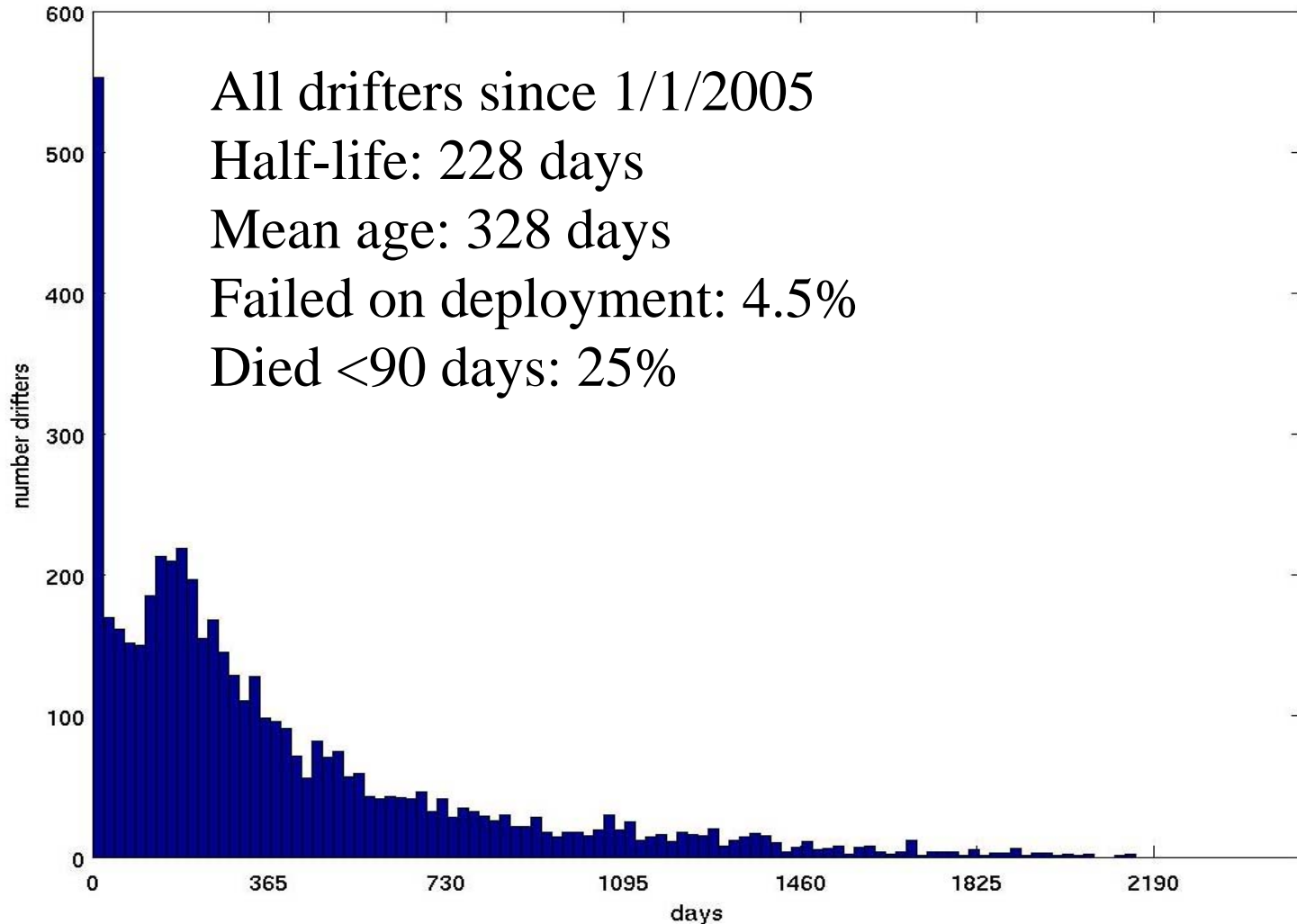
Simple example: 100 drifters are deployed, the half life is the number of days it takes 50 drifters to die

If more than half are still alive, we can calculate an “at least” half life:

- 1) For still alive drifters: use age (so far) instead of death age.
- 2) Calculate half-life using all ages.
- 3) Remove “still-alive” ages that are $<$ half life.
- 4) Repeat 2, 3 until all “still-alive” ages are $>$ half life.

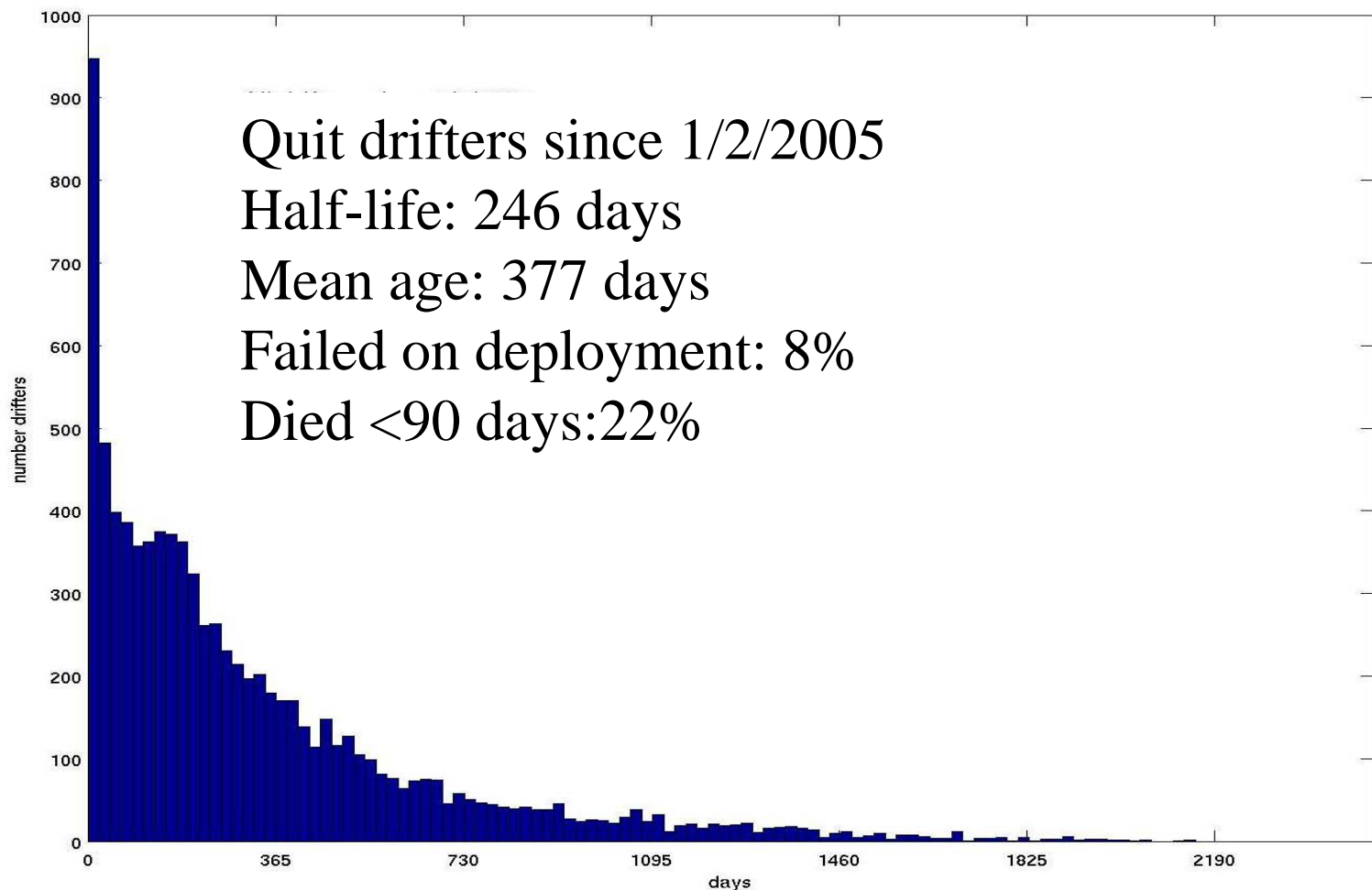
Age at death (all causes)

All drifters in study period. Includes quit, ran aground, picked up, and Failed on Deployment.

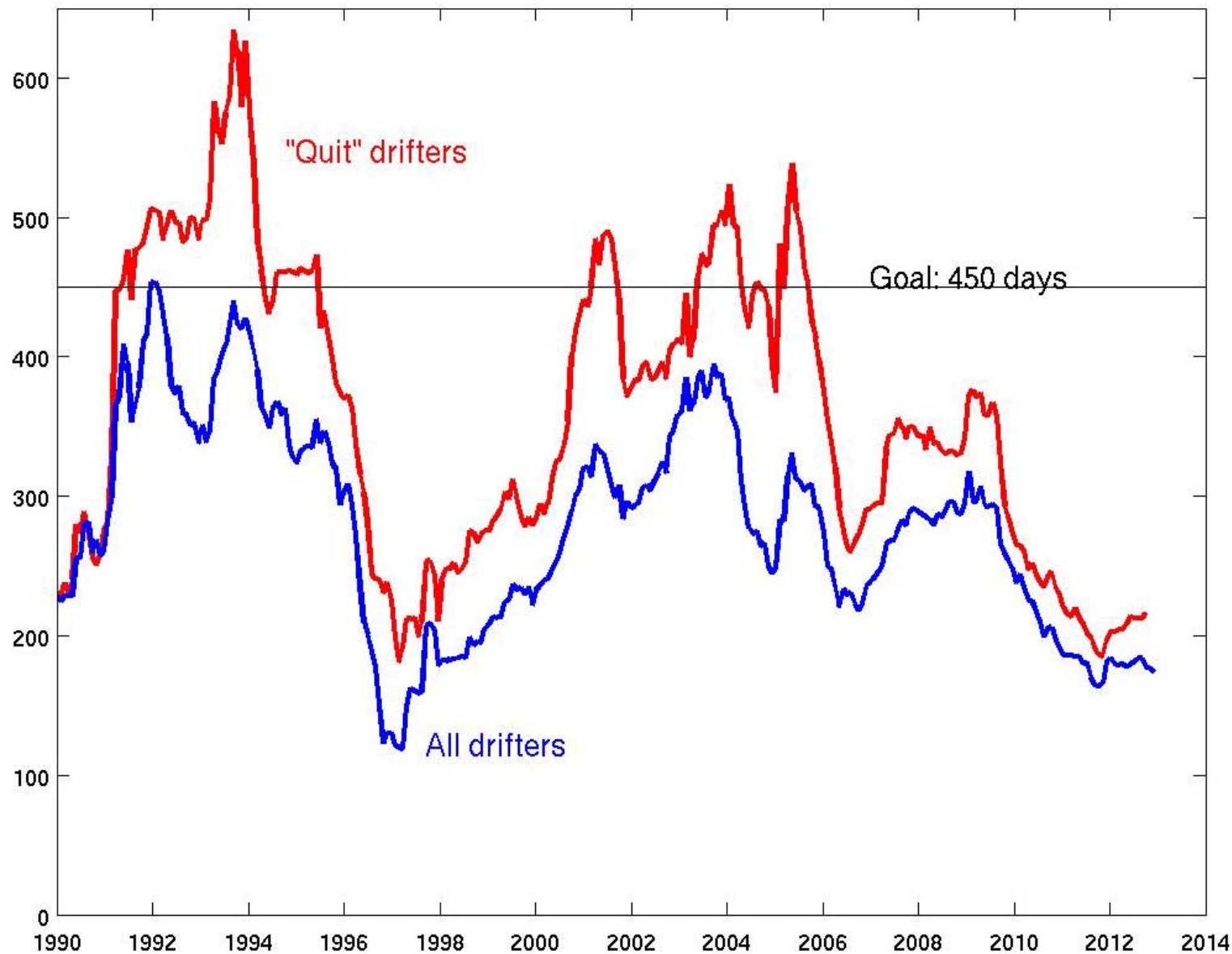


Age at death (“quit” drifters)

“Quit” means “quit transmitting”, with estimated chance of “ran aground” or “picked up” (Lumpkin, Maximenko and Pazos, 2012) less than 25%. Includes “failed on deployment”. Excludes all deaths poleward of 55°N/S (may have been caused by ice).



How has this half life changed over time?



Number of deployments

Number of drifters deployed each year, by manufacturer

2013: values through 30 June.

Manufacturer	2006	2007	2008	2009	2010	2011	2012	2013
Clearwater	440	469	390	355	445	259	409	38
DBi	0	0	0	0	0	4	158	148
Marlin-Yug	5	6	17	24	11	0	7	0
Metocean	75	220	143	216	199	219	146	21
Pacific Gyre	111	113	270	264	231	357	161	54
SIO	0	0	0	0	0	0	104	120
Technocean	287	274	175	279	394	252	29	11

From 2006-2010, the majority of the array was composed of Clearwater, Technocean, Pacific Gyre, and Metocean drifters. Starting in 2012, SIO and DBi drifters were introduced while Clearwater and Technocean have been decreasing.

Number of deaths

How many drifters died each year, for all causes

(quit, ran aground, picked up). Includes Failed on Deployment

2013: values through 30 June. **Bold:** >1.5× more than number deployed that year

Manufacturer	2006	2007	2008	2009	2010	2011	2012	2013
Clearwater	394	543	487	391	458	361	337	145
DBi	0	0	0	0	0	1	53	79
Marlin-Yug	0	1	14	24	8	7	4	2
Metocean	65	110	186	150	233	258	201	44
Pacific Gyre	178	99	193	206	225	271	383	105
SIO	0	0	0	0	0	0	50	54
Technocean	367	278	268	260	345	434	226	59

How many drifters quit?

“quit transmitting”, with estimated chance of “ran aground” or “picked up” (Lumpkin, Maximeko and Pazos, 2012) less than 25%. Includes “failed on deployment”. Doesn’t include deaths poleward of 55°N/S (possibly due to ice).

Percent: number that quit that year, divided by number deployed.

2013: values through 30 June. **Bold:** >100%

Manufacturer	2006	2007	2008	2009	2010	2011	2012	2013
Clearwater	34%	63%	78%	67%	71%	95%	59%	287%
DBi	*	*	*	*	*	25%	15%	28%
Marlin-Yug	0%	17%	18%	8%	36%	*	43%	*
Metocean	40%	30%	87%	37%	67%	69%	84%	152%
Pacific Gyre	58%	53%	37%	43%	61%	51%	164%	135%
SIO	*	*	*	*	*	*	21%	25%
Technocean	47%	39%	69%	43%	45%	115%	624%	436%

Half-life of drifters (days)

Number of days after which half are dead, as function of deployment year. Includes all drifters (quit, ran aground, picked up, and failed on Deployment.

Values through 30 June 2013. **Bold:** less than 200 days (**Large:** <100 days)

All drifters:

Manufacturer	2006	2007	2008	2009	2010	2011	2012	2013
Clearwater	207	206	253	217	163	140	192	>137
DBi	*	*	*	*	*	>324	236	>155
Marlin-Yug	752	577	78	162	466	*	>371	*
Metocean	356	370	396	384	211	190	150	>109
Pacific Gyre	102	212	231	284	284	208	165	>96
SIO	*	*	*	*	*	*	137	>109
Technocean	393	522	497	476	262	148	53	0

Half-life of drifters (days)

Number of days after which half are dead, as function of deployment year. Excludes drifters “ran aground” and “picked up”

2013: values through 30 June. **Bold:** less than 200 days

"Quit" drifters:

Manufacturer	2006	2007	2008	2009	2010	2011	2012	2013
Clearwater	232	251	217	213	160	159	204	>156
DBi	*	*	*	*	*	>324	>288	>175
Marlin-Yug	849	635	856	634	>771	*	>408	*
Metocean	384	402	456	445	274	221	184	>110
Pacific Gyre	158	264	598	336	345	237	209	>137
SIO	*	*	*	*	*	*	186	>152
Technocean	558	673	959	645	289	192	54	0

Percent which live <90 days

quit at <90d divided by # deployed that year. Includes Failed on Deployment

2013: values through 30 June. **Bold:** more than 10%. **Large:** >20%.

Manufacturer	2006	2007	2008	2009	2010	2011	2012	2013
Clearwater	8%	7%	11%	11%	26%	27%	12%	5%
DBi	*	*	*	*	*	25%	9%	7%
Marlin-Yug	0%	0%	6%	0%	18%	*	14%	*
Metocean	4%	7%	5%	6%	5%	11%	18%	19%
Pacific Gyre	22%	12%	12%	17%	4%	5%	8%	4%
SIO	*	*	*	*	*	*	6%	8%
Technocean	13%	9%	8%	4%	11%	32%	55%	91%

DROGUE HALF-LIFE (DAYS)

Number of days after which half of drifters lose their drogue , as function of deployment year.

2013: values through 30 June. **Bold:** less than **100 days**.

Manufacturer	2006	2007	2008	2009	2010	2011	2012	2013
Clearwater	62	72	101	104	95	84	>272	>136
DBi	*	*	*	*	*	288	224	>156
Marlin-Yug	197	152	72	57	167	*	0	*
Metocean	304	>373	269	224	77	89	>110	> 95
Pacific Gyre	>282	210	199	241	248	207	>190	>110
SIO	*	*	*	*	*	*	71	> 89
Technocean	29	45	33	63	77	154	> 62	0

PERCENT THAT HAD DROGUE OFF <90 DAYS

drifters lose their drogue at <90d divided by # deployed that year.

2013: values through 30 June. **Bold:** more than 25%.

Manufacturer	2006	2007	2008	2009	2010	2011	2012	2013
Clearwater	60%	55%	36%	30%	36%	39%	14%	5%
DBi	*	*	*	*	*	25%	9%	13%
Marlin-Yug	0%	0%	41%	46%	36%	*	43%	*
Metocean	17%	13%	17%	26%	40%	46%	35%	33%
Pacific Gyre	32%	20%	23%	17%	10%	16%	25%	9%
SIO	*	*	*	*	*	*	36%	22%
Technocean	62%	65%	78%	53%	46%	27%	31%	18%

PERCENT THAT HAD DROGUE OFF <10 DAYS

drifters lose their drogue at <10d divided by # deployed that year.

2013: values through 30 June. **Bold:** more than 10%.

Manufacturer	2006	2007	2008	2009	2010	2011	2012	2013
Clearwater	6%	7%	4%	7%	7%	5%	2%	3%
DBi	*	*	*	*	*	0%	4%	1%
Marlin-Yug	0%	0%	24%	33%	9%	*	43%	*
Metocean	7%	8%	13%	6%	12%	6%	8%	0%
Pacific Gyre	7%	8%	12%	8%	2%	4%	7%	0%
SIO	*	*	*	*	*	*	24%	2%
Technocean	27%	10%	11%	10%	9%	3%	14%	18%

Iridium Drifters Transmitters' Life

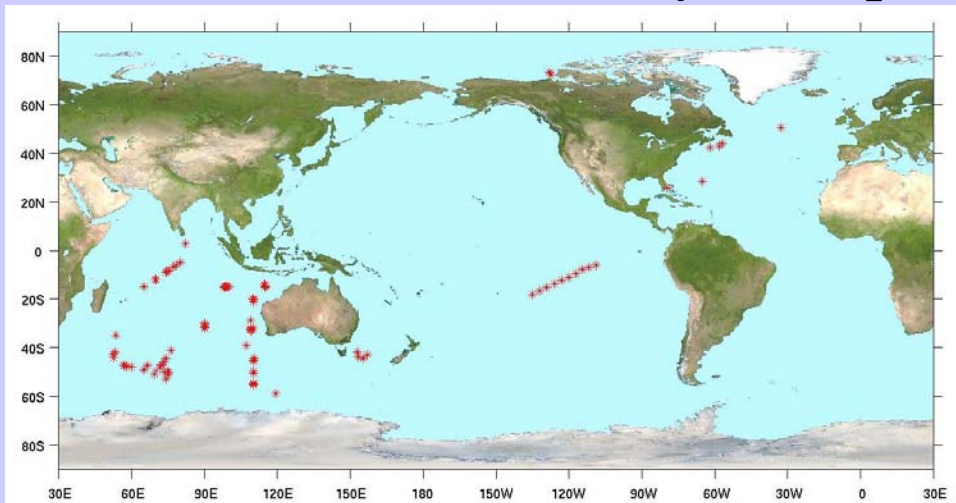
Quit buoys (not picked up or grounded)

Deployment positions of Iridium drifters, processed at Joubeh and in AOML database through June 2013

Total of **96** drifters

93 Metocean, 3 Pacific Gyre

69=quit; 9=grounded; 18 alive

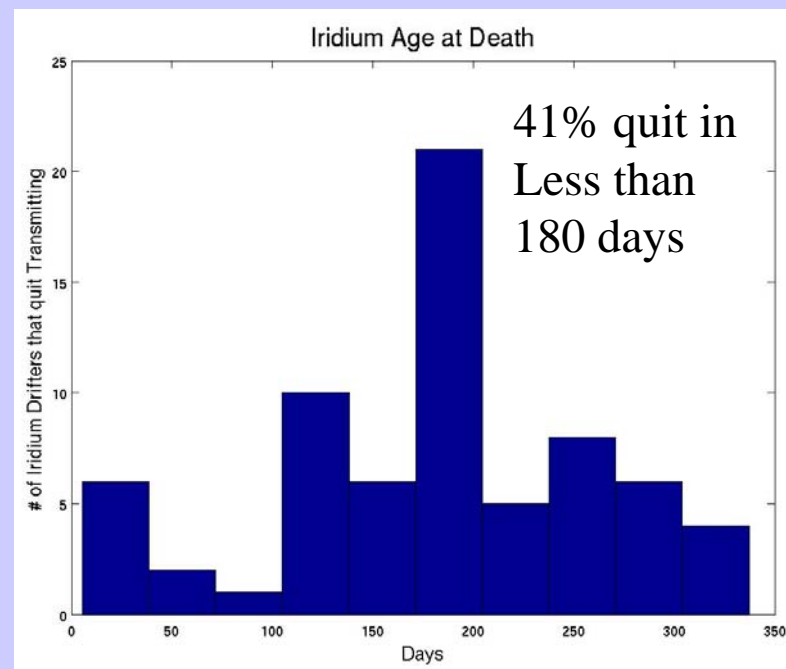


Half Life = **195** days

Mean Life = **182** days

41% quit in less than 180 days

(Compared to Argos drifters since 1/1/2005: 229 days half life)



Salinity drifters with GPS

Salinity drifters manufactured by Pacific Gyre were deployed for the SPURS project in the Tropical Atlantic region in 2012

Number of salinity drifters: 38

Half-life of good salinity measurements: 224 days

Mean lifetime (so far): 222 days

Fraction with bad/dead SST/SSS at <10 days: 5%

Fraction with bad/dead SST/SSS at <90 days: 11%

The half-life of these Salinity GPS drifters is very similar to that of standard SVP drifters.

Summary

- The half-life of an average drifter is 229 days. If it does not run aground or gets picked up, the half-life increases to 245 days. Goal: 450 days.
- ***SIO***: Drifters first deployed in 2012. Half life 186d in 2012. Half life >152d in first half of 2013. Drogue off <90d 22% first half of 2013.
- ***Metocean***: half-life 300—400d until 2010 when it fell to 274d and decreasing each year since (“quit” drifters). Buoys that live <90d at death increasing since 2010.
- ***Pacific Gyre***: Lowest percentage of short-lived drifters since 2010. Half life of “quit drifters decreasing since 2010, 4-5% die at <90d.
- ***DBi***: Drifters first deployed in late 2011. Half life >288d in 2012 and >175d in first half of 2013. Drogue half life 224d in 2012 and >156 in first half of 2013.
- ***Clearwater and Technocean***: Decreasing number of deployments in 2013 and have ceased manufacturing drifters.
- **Iridium drifters**: half life of 195 days, mean lifetime 182 days, 41% quit before 180 days. Performance not yet as good as Argos drifters, and far below 450 day goal.
- **Salinity drifters**: SPURS drifters deployed in 2012 have half life of 224d. Similar half life to standard SVP drifters

Thank You
Any Questions?