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Classification and visualisation of estimates and their uncertainty

2020-02-03

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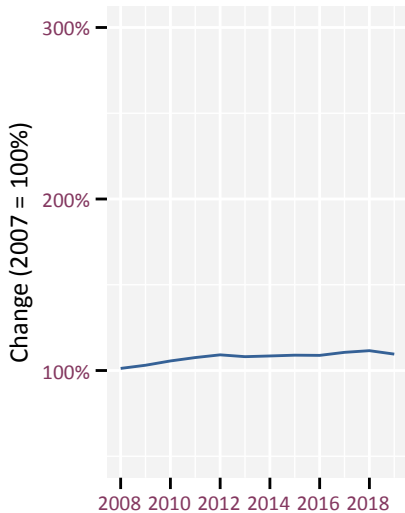
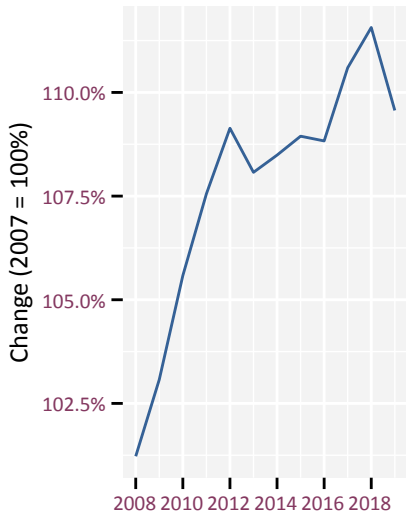


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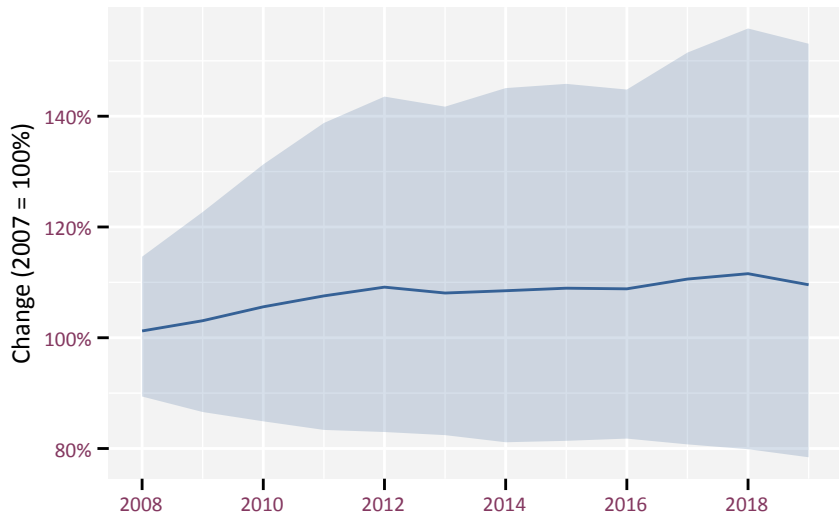
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Introduction

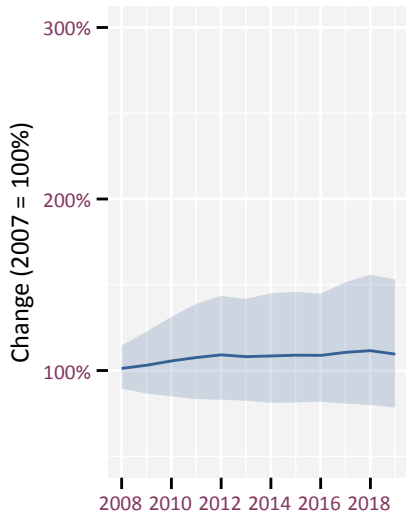
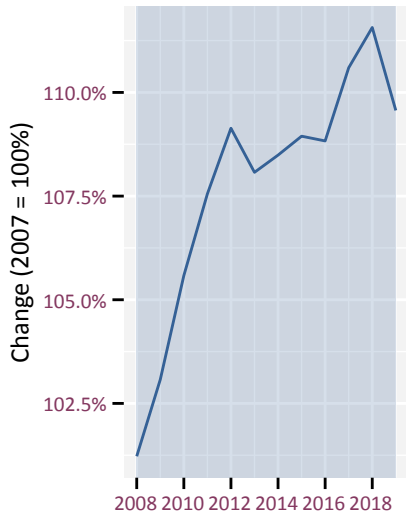
Interpretation of estimates without information of uncertainty



Estimates with uncertainty



Unappropriate limits in combination with uncertainty



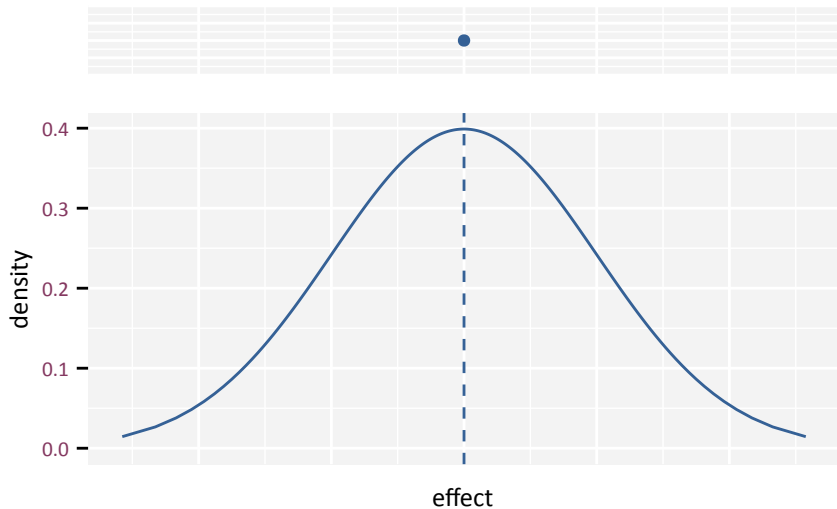


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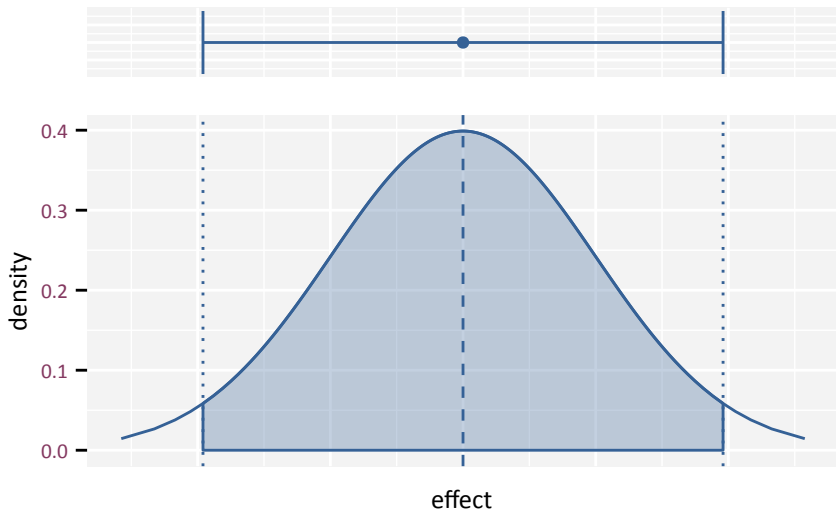
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Uncertainty

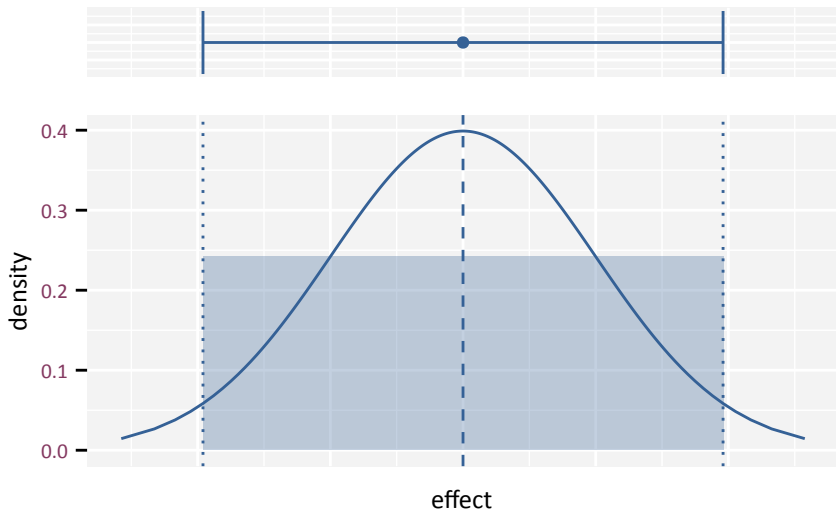
Point estimate



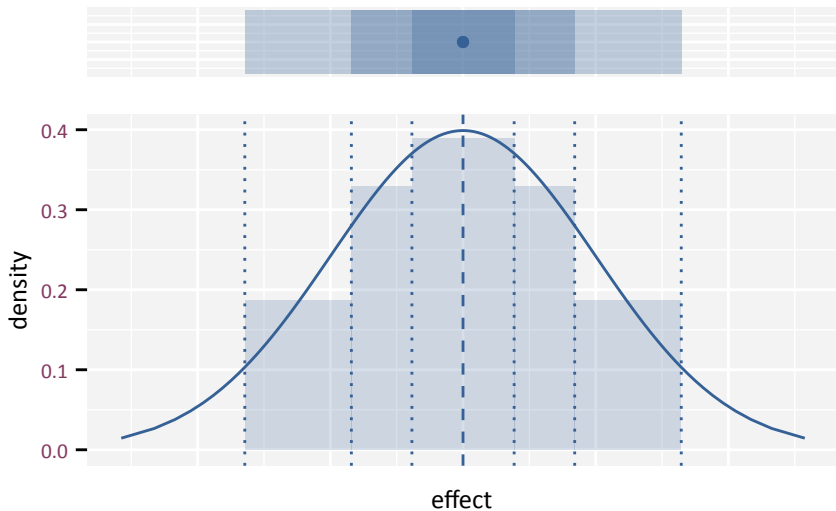
Confidence interval



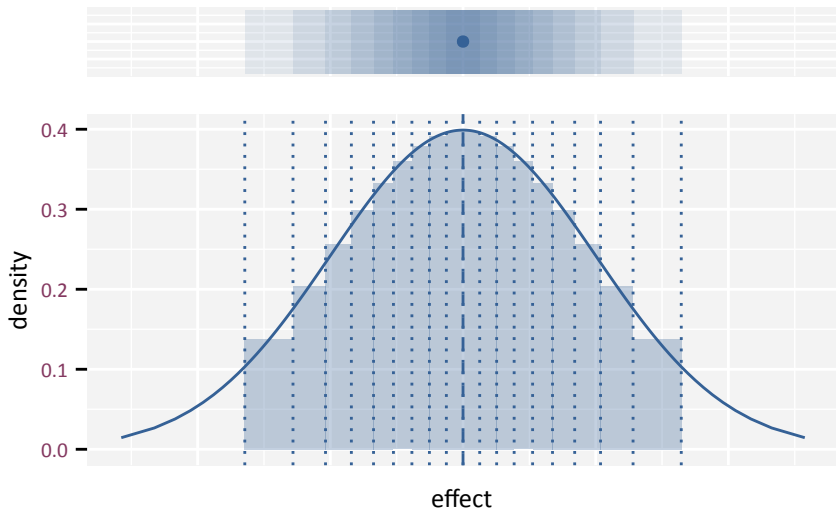
Confidence interval



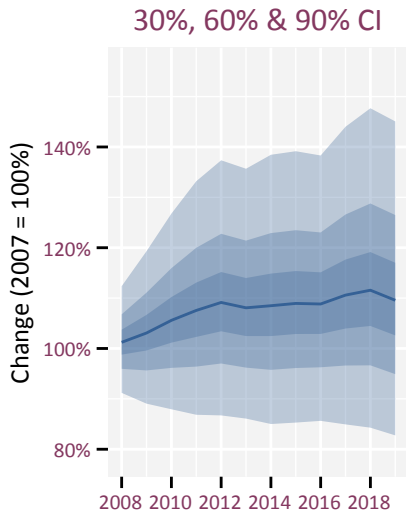
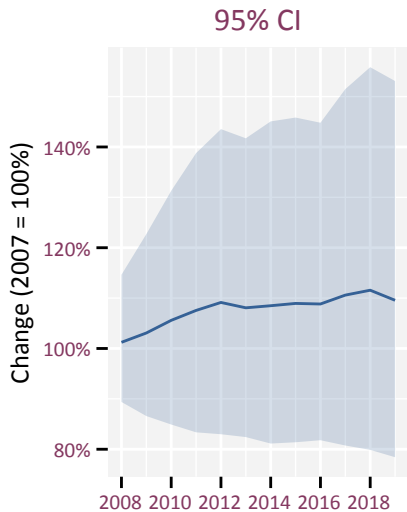
30%, 60% and 90% confidence interval



9 confidence intervals (10% increments)



Example





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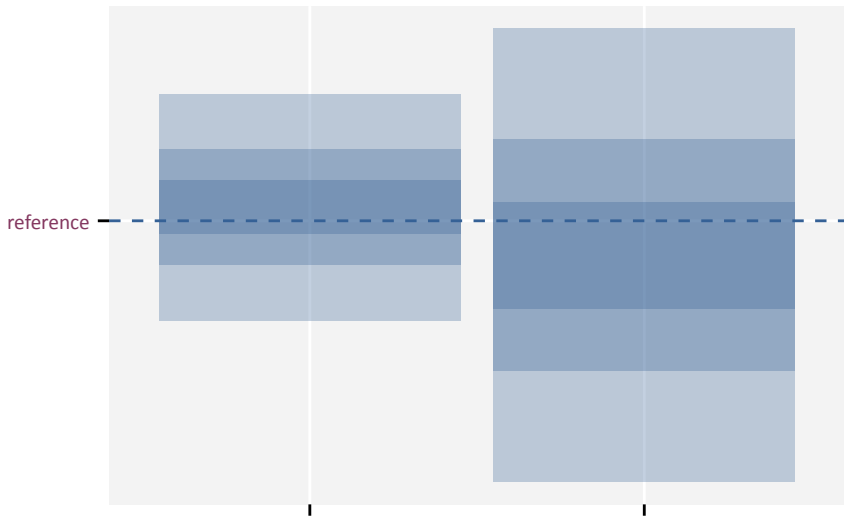
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Classification of estimates

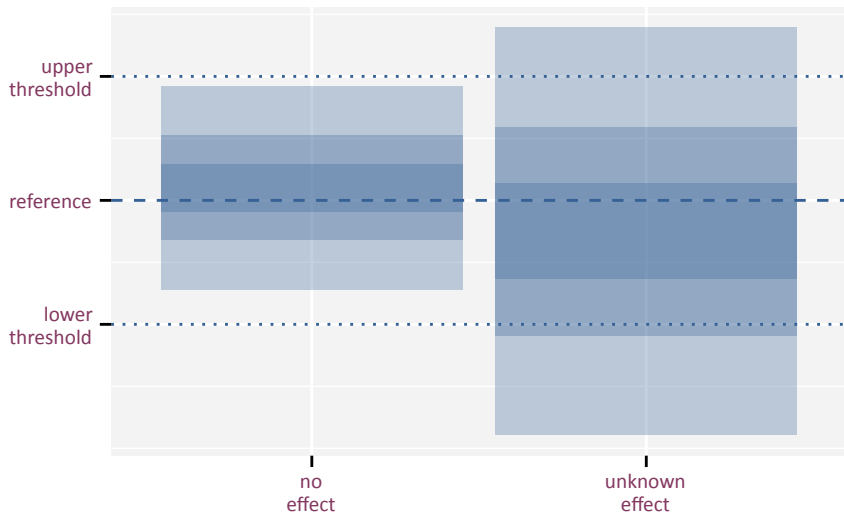
Significant effects



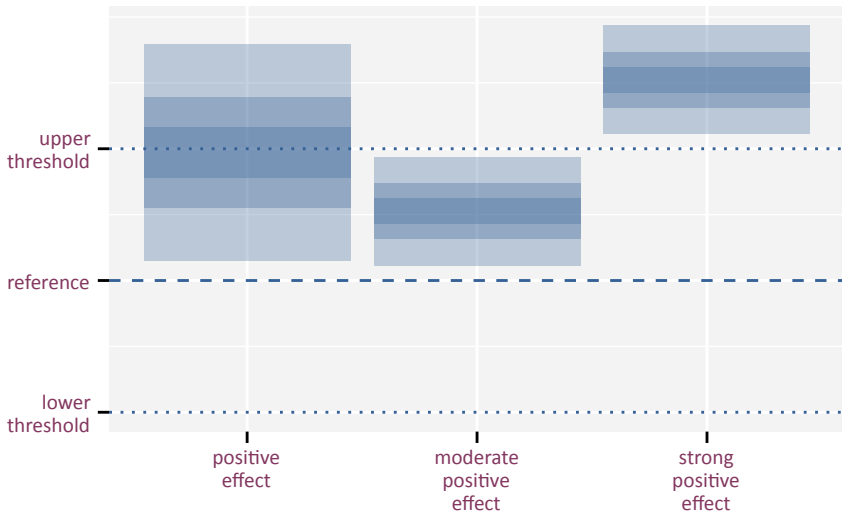
Non significant effects



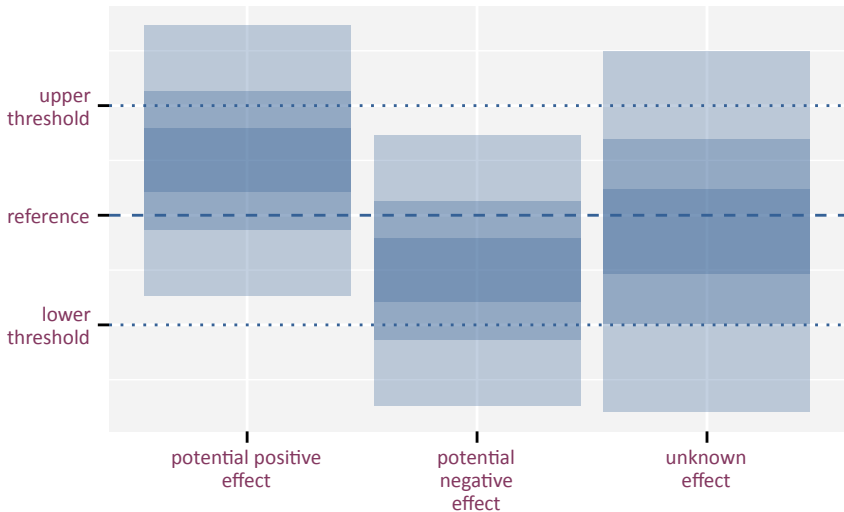
Non significant effects



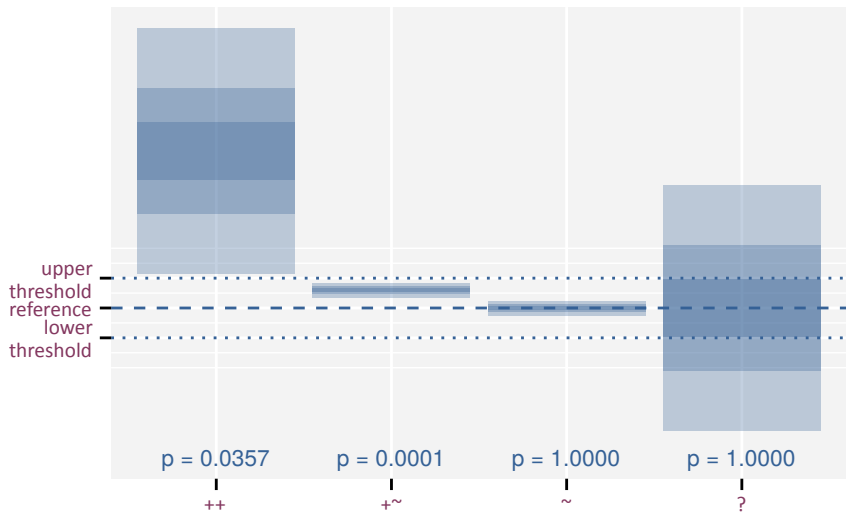
Detailed classification of positive effects



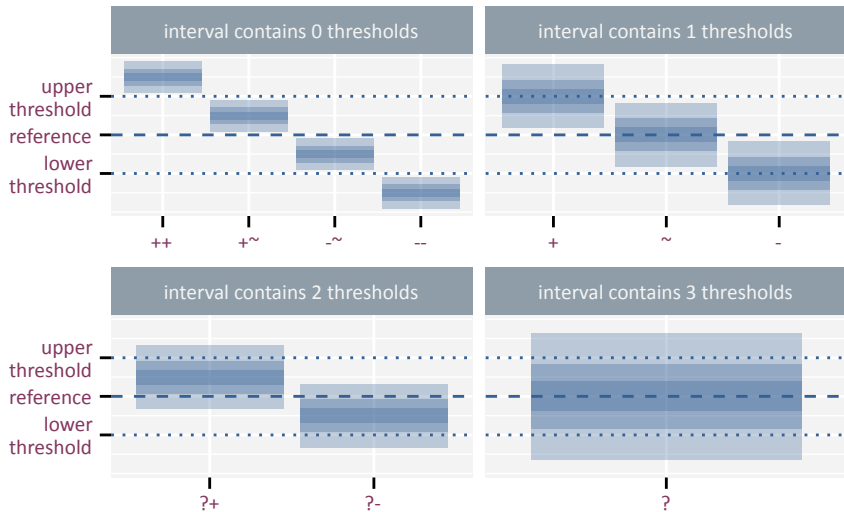
Detailed classification of unknown effects



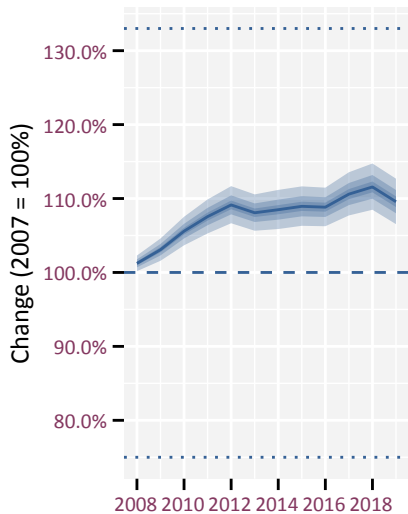
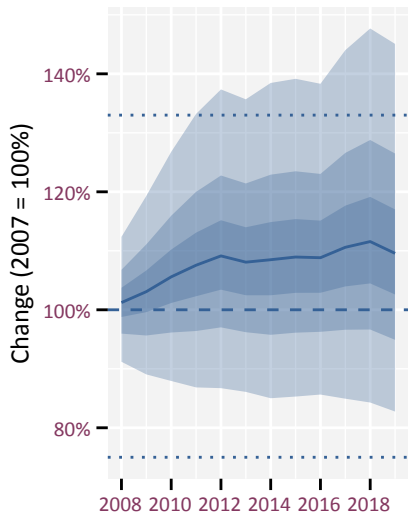
Why don't you use p-values?



Overview



Example



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How to define reference and thresholds?

Width of the confidence interval

“The value for which $p = 0.05$, or 1 in 20, is 1.96 or nearly 2; it is convenient to take this point as a limit in judging whether a deviation is to be considered significant or not.” (Fisher, 1925)

- ▶ two-sided test with $p = 0.05$ as threshold
 - ▶ $p = 0.05/2 = 0.025$ on each side
 - ▶ 2.5% and 97.5% quantiles = 95% CI
- ▶ smaller CI
 - ▶ larger p
 - ▶ more false positives & fewer false negatives

	no effect	effect
not significant	TN	FN
significant	FP	TP



Change detection in ecology: fewer false negatives = early warning

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Reference

- ▶ Null hypothesis
- ▶ A model parameter is zero
 - ▶ No effect of treatment X
 - ▶ No change in time
 - ▶ e.g. Natura2000: population remains stable
- ▶ A prespecified target
 - ▶ e.g. PARTRIDGE: population increases by 30% over 4 years

Threshold

- ▶ Effect size from power analysis
 - ▶ e.g. Natura 2000: detect -25% over 24 year
- ▶ Expert judgement
 - ▶ What change is large enough to be relevant / important?
 - ▶ What change is small enough to be irrelevant / not important?
 - ▶ Do consult a statistician



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Tools

effectclass

<https://effectclass.netlify.com> (Onkelinx, 2020)

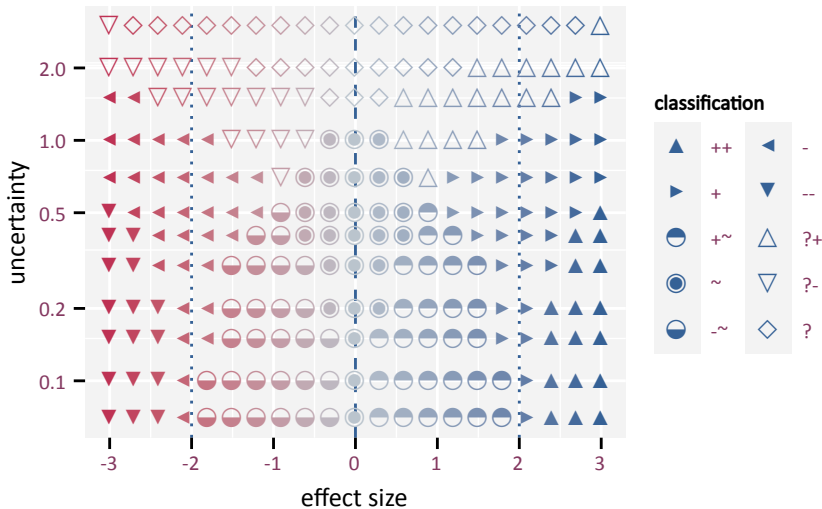
functions

- ▶ `classification()`: classifies intervals based on a reference and thresholds
- ▶ `format_ci()`: format an effect size with its confidence interval
- ▶ `stat_fan()`: fan plot based on mean and standard error
- ▶ `stat_effect()` + `scale_effect()`: display point with shape based on classification

classification(reference = 3, threshold = c(2, 4))
and format_ci()

estimate	se	lcl	ucl	class	formatted
4.712389	0.01	4.6959404	4.7288375	++	4.712 (4.696; 4.729)
4.712389	0.10	4.5479036	4.8768743	++	4.71 (4.55; 4.88)
4.712389	1.00	3.0675354	6.3572426	+	4.7 (3.1; 6.4)
3.141593	0.01	3.1251441	3.1580412	+~	3.142 (3.125; 3.158)
3.141593	0.10	2.9771073	3.3060780	~	3.14 (2.98; 3.31)
0.000000	0.01	-0.0164485	0.0164485	--	0.0000 (-0.0164; 0.0164)
0.000000	0.10	-0.1644854	0.1644854	--	0.000 (-0.164; 0.164)
0.000000	1.00	-1.6448536	1.6448536	--	0.00 (-1.64; 1.64)
1.570796	0.01	1.5543478	1.5872449	--	1.5708 (1.5543; 1.5872)
1.570796	0.10	1.4063110	1.7352817	--	1.571 (1.406; 1.735)
1.570796	1.00	-0.0740573	3.2156500	?-	1.6 (-0.1; 3.2)
3.141593	1.00	1.4967390	4.7864463	?	3.1 (1.5; 4.8)

stat_effect() + scale_effect()





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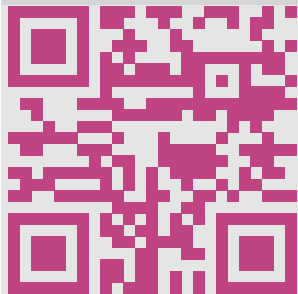
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Your feedback

Questions for the audience

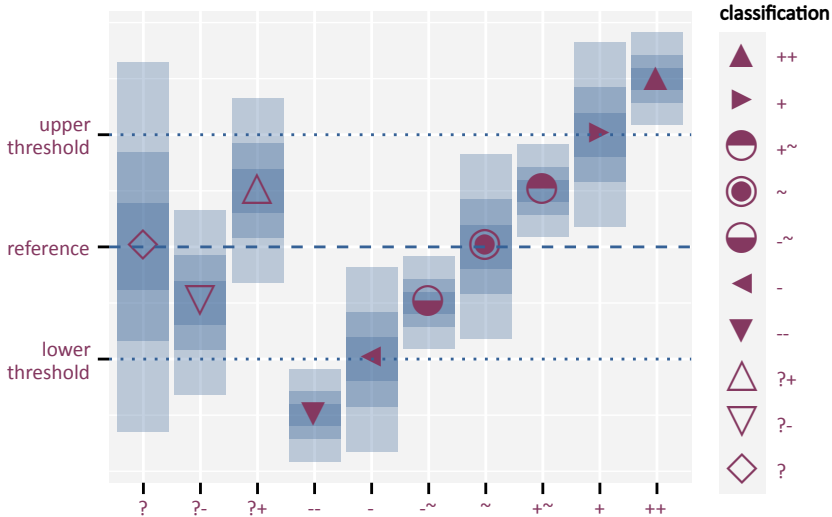
- ▶ How do you feel about the fan-plots?
- ▶ Is the classification easy to understand and use?
- ▶ Should we use a standardised symbology and terminology?

effectclass



<https://effectclass.netlify.com>

Suggested symbology



Suggested terminology

Class	trend	state
++	strong increase	goal strongly exceeded
+	increase	goal exceed
+~	moderate increase	goal moderately exceeded
~	stable	goal reached
-~	moderate decrease	goal almost achieved
-	decrease	goal not achieved
--	strong decrease	goal clearly not achieved
?+	potential increase	goal maybe achieved
?-	potential decrease	goal maybe not achieved
?	unclear	unknown if goal achieved

effectclass

<https://effectclass.netlify.com>



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Referenties I

Fisher, R. (1925). *Statistical Methods for Research Workers*. Oliver and Boyd, Edinburgh. ISBN 978-0-05-002170-5.

Onkelinx, T. (2020). *effectclass: Classification and visulation of effects*. URL <https://effectclass.netlify.com>. R package version 0.1.2.