Modelação Ecológica

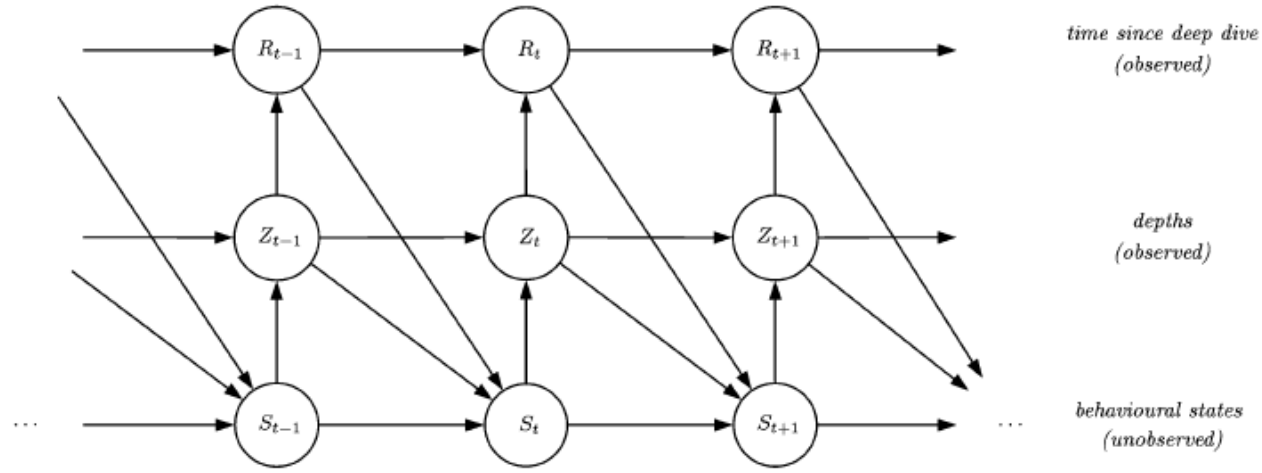
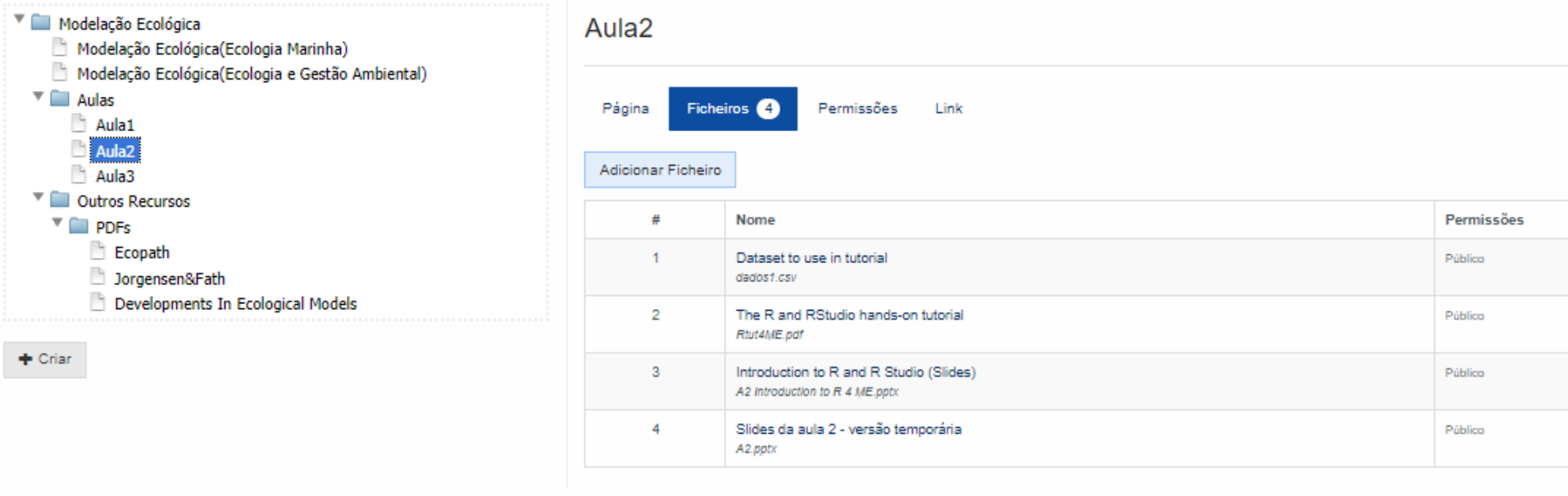


Figure 2. Dependence structure of a feedback Markov-switching model for the time series of depths.

In: Langrock et al. 2014 JABES 19: 82-100

Onde está o material desta aula?



COMO CONCEPTUALIZAR A REALIDADE

Essa é provavelmente a parte mais dificil de todas, e vem fundamentalmente da experiência:

"Skill in the process of simulation modelling is gained primarily through (1) practice, (2) practice, and (3) practice!"

In Grant & Swannack 2008

They also say

"However, a keen awareness of what we are doing (in practice), why we are doing it (in theory), and why it makes (common) sense, is invaluable…

Thus we have organized this book to emphasize the "oneness" of theory, practice, and common sense"

COMO CONCEPTUALIZAR A REALIDADE

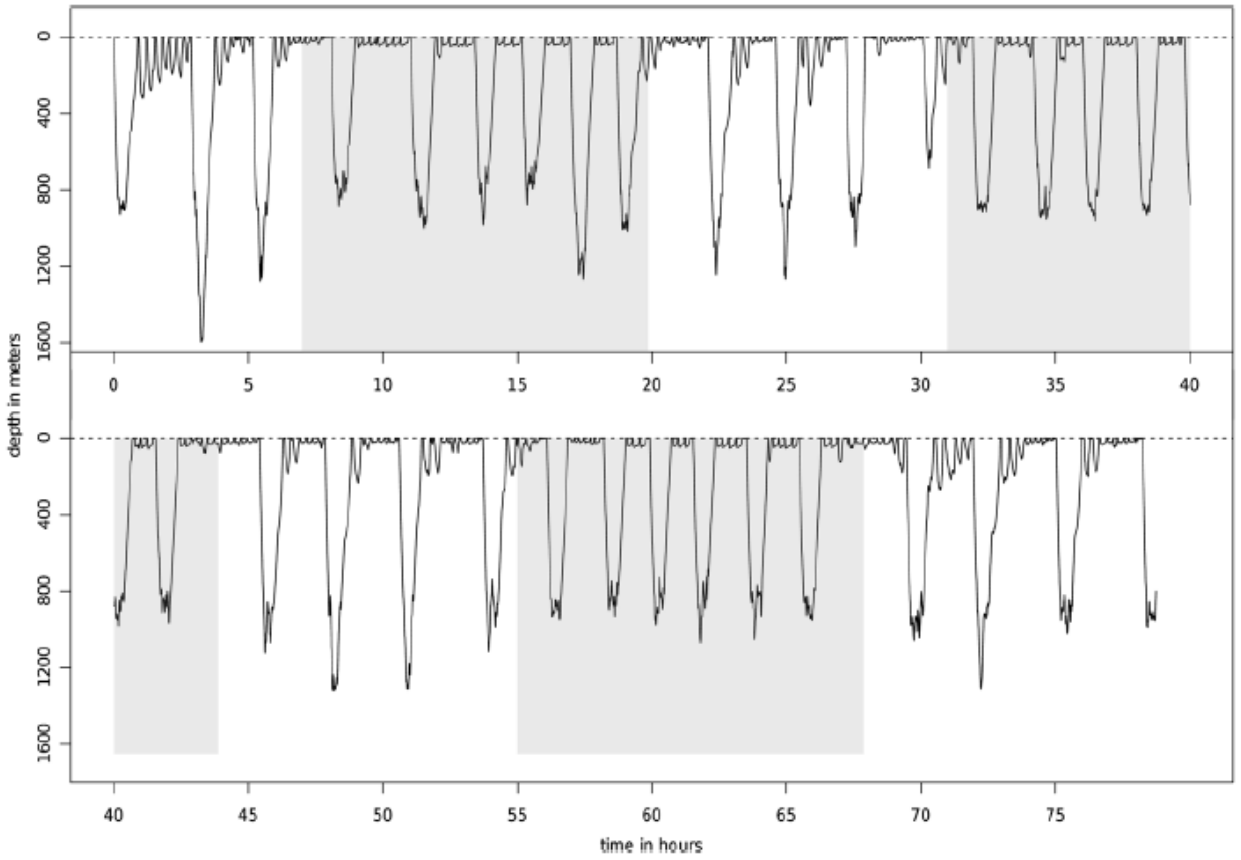
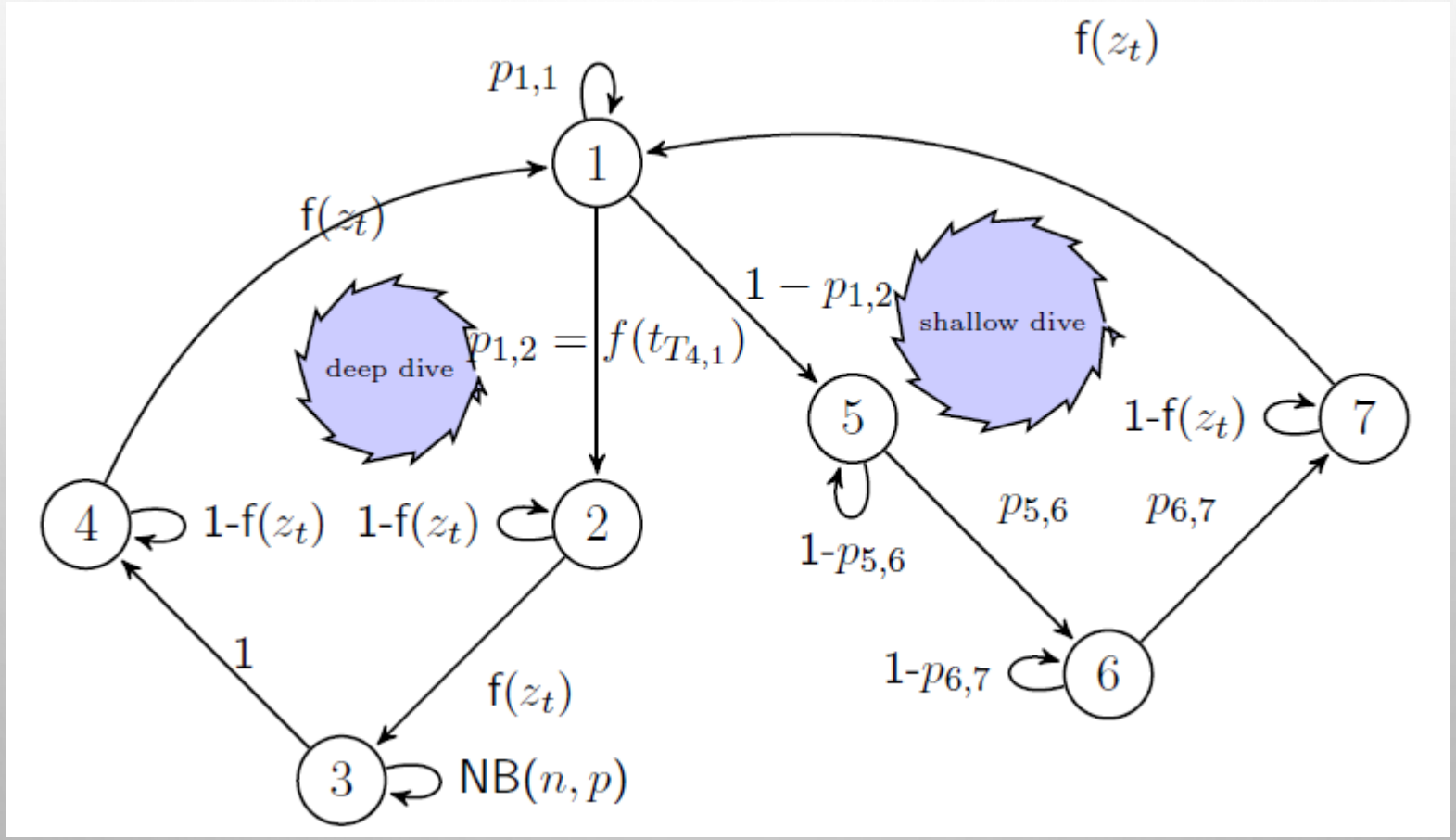


Figure 1. Beaked whale depth profile. The shaded periods correspond to "night" periods, between 17:44 h (sunset) and 06:37 h (sunrise).

Langrock, R.; Marques, T. A.; Thomas, L. & Baird, R. W. 2014 Modeling the diving behavior of whales: a latent-variable approach with feedback and semi-Markovian components *Journal of Agricultural, Biological, and Environmental Statistics* **19**: 82-100

COMO CONCEPTUALIZAR A REALIDADE

Fit a feedback hidden semi-Markov model



COMO CONCEPTUALIZAR A REALIDADE

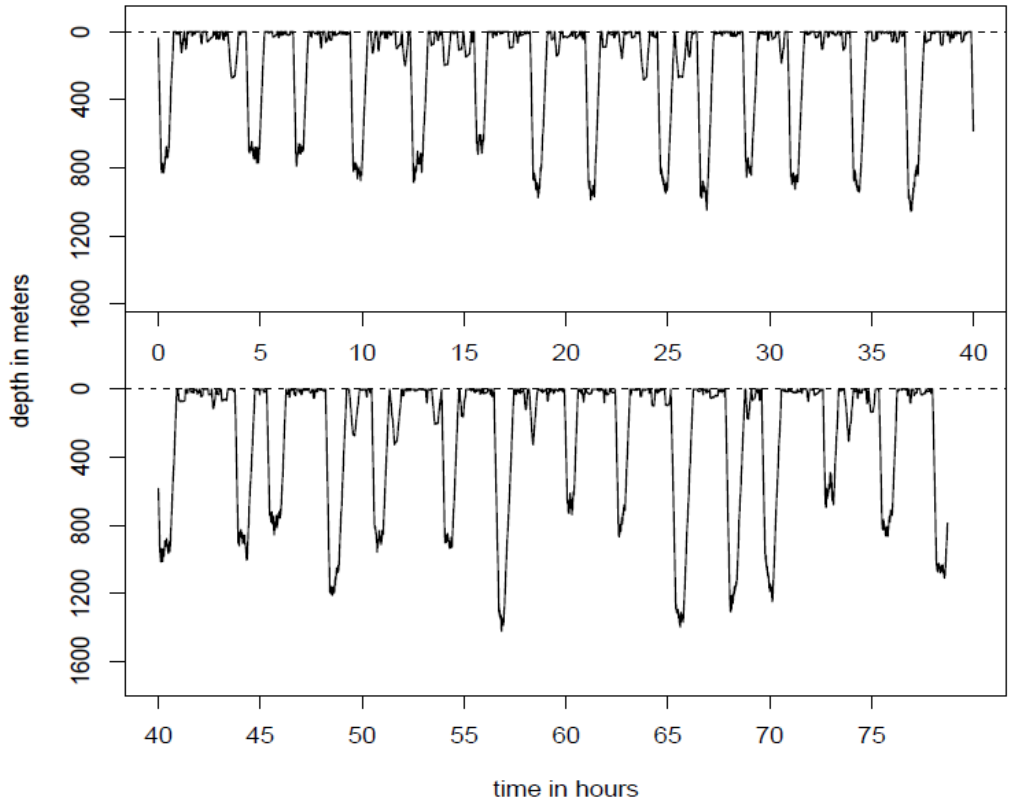
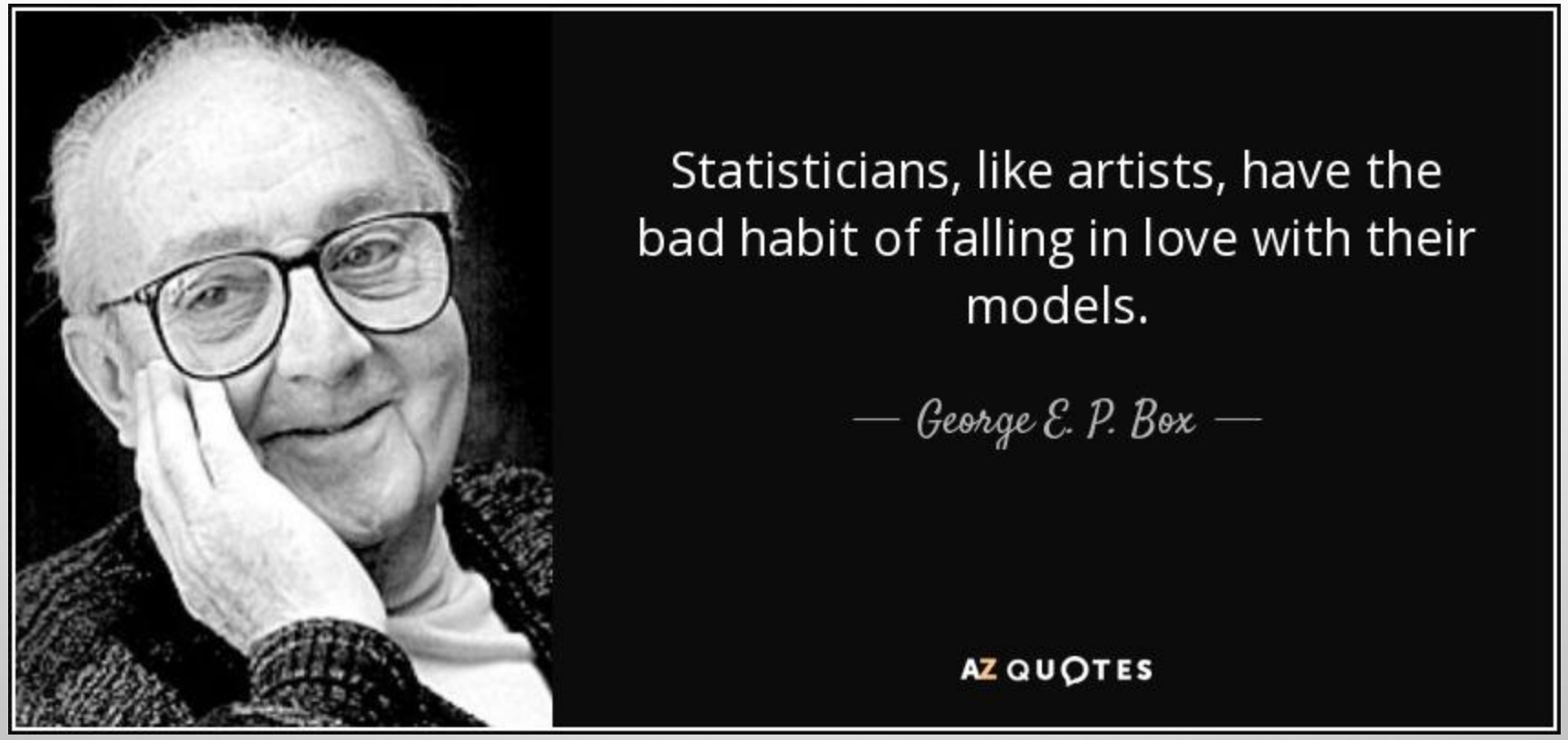


Figure 15: A realization of a depth profile simulated from the model fitted to data from Langrock *et al.* (2013).



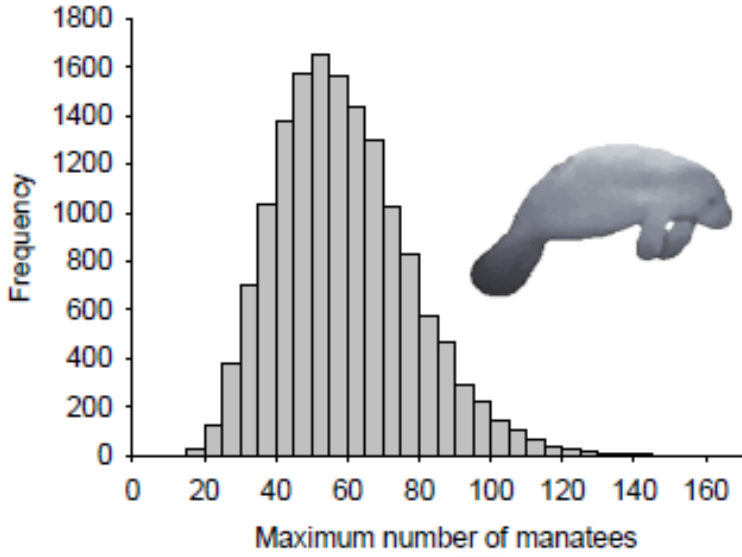
https://www.azquotes.com/quote/603404

A FEW YEARS AGO

- REVIEW A PAPER FOR A GOOD ECOLOGICAL JOURNAL (JOURNAL OF APPLIED ECOLOGY!)
- DEEPWATER HORIZON: USING BAYESIAN INFERENCE TO ESTIMATE THE MAXIMUM NUMBER OF FLORIDA MANATEES IN AREAS POTENTIALLY AFFECTED BY OIL
- A QUITE COMPLEX HIERARCHICAL BAYESIAN MODEL TO PREDICT NUMBER OF AFFECTED MANATEES FROM THE DEEPWATER HORIZON OIL SPILL, USING MULTIPLE SOURCES OF DATA

We estimated that up to 108 manatees were present in the areas potentially impacted by the oil spill during our surveys (Fig. 2). The posterior mean was 62 manatees, with a 95% interval of (250 30 to 108) (Fig. 2).

Figure 2



Posterior distribution for the maximum number of manatees in Florida in manatee habitats affected by the Deepwater Horizon oil spill, estimated with an integrated model using a Bayesian approach

Alguns dos meus comentários…

- WHILE I FIND THE PAPER WELL WRITTEN AND CLEAR, WITH AN INTERESTING MODEL BEING DESCRIBED, I CAN GET PAST THE INTUITIVE VERY BAD FEELING THAT I HAVE AFTER READING IT. DURING THE ACTUAL SURVEY, NO SINGLE ANIMAL WAS DETECTED. THIS MEANS THAT AT THE END OF THE DAY THE AUTHORS ARE DESCRIBING A MODEL WHICH:
- WOULD ESTIMATE ABOUT THE SAME NUMBER OF MANATEES TO BE IN THE AREA WERE THE SURVEY CONDUCTED IN 1998, 2011 OR 2015. THIS IS A COMPLETE NONSENSE BECAUSE ONE OF THE MAIN CONSEQUENCES OF THE OIL MIGHT BE ANIMAL DISPLACEMENT, AND HENCE, IT'S BOUND TO BE THE CASE THAT ABUNDANCE WOULD CHANGE CONSIDERABLY OVER TIME. WHAT IS EXACTLY THE TEMPORAL SCALE OVER WHICH THE AUTHORS BELIEVE THEIR INFERENCES APPLY?
- WOULD ACTUALLY MEAN THAT ABOUT THE SAME NUMBER (WELL, SORT OF, BECAUSE THE COVARIATES HAVE SOME INFLUENCE ON IT, BUT STILL) OF MANATEES WOULD BE ESTIMATED TO BE IN A SIMILAR AREA WHERE THERE ARE ACTUALLY NO MANATEES AT ALL, SAY IT BE IN SOUTH AMERICA, AUSTRALIA OR AFRICA. CERTAINLY THIS SHOWS US THAT THERE ARE SOME STRONG UNDERLYING ASSUMPTIONS BEING MADE WHICH ARE AT BEST IMPLICIT AND NOT DISCUSSED.

ECOLOGICAL STATISTICS IS MUCH MORE THAT STATISTICAL SIGNIFICANCE TESTS

NULL HYPOTHESIS TESTING: PROBLEMS, PREVALENCE, AND AN ALTERNATIVE

DAVID R. ANDERSON,[1,2] Colorado Cooperative Fish and Wildlife Research Unit, Room 201 Wagar Building, Colorado State University, Fort Collins, CO 80523, USA
KENNETH P. BURNHAM,[1] Colorado Cooperative Fish and Wildlife Research Unit, Room 201 Wagar Building, Colorado State University, Fort Collins, CO 80523, USA
WILLIAM L. THOMPSON, U.S. Forest Service, Rocky Mountain Research Station, 316 E. Myrtle St., Boise, Idaho 83702, USA

of Wildlife Management found the use of null hypothesis testing to be pervasive. The estimated number of *P*-values appearing within articles of *Ecology* exceeded 8,000 in 1991 and has exceeded 3,000 in each year since 1984, whereas the estimated number of *P*-values in the *Journal of Wildlife Management* exceeded 8,000 in 1997 and has exceeded 3,000 in each year since 1994. We estimated that 47% (SE = 3.9%) of the *P*-values in the *Journal of Wildlife Management* lacked estimates of means or effect sizes or even the sign of the difference in means or other parameters. We find that null hypothesis testing is uninformative when no estimates of means or effect size and their precision are given. Contrary to common dogma, tests of statistical

Uma mudança de paradigma: em vez de fazer testes de hipóteses até à exaustão, conceptualizer modelos e avaliar quais os que são mais suportados pelos dados

Anderson, D. R.; Burnham, K. P. & Thompson, W. L. 2000 Null hypothesis testing: problems, prevalence, and an alternative *Journal of Wildlife Management* 64: 912-923

DIFERENÇAS ESTATÍSTICAS E BIOLÓGICAS

AUMENTANDO O TAMANHO DA AMOSTRA ATÉ AO INFINITO, QUALQUER DIFERENÇA SE TORNA ESTATISTICAMENTE SIGNIFICATIVA…

MAS E ENTÃO, O QUE QUER ISSO DIZER?

HÁ PERGUNTAS QUE NÃO FAZEM GRANDE SENTIDO!

- AS ÁRVORES DA FLORESTA A SÃO DIFERENTES DAS DA FLORESTA B? SÃO!
- OS PEIXES DO RIO C SÃO DIFERENTES DOS DO RIO D? SÃO!
- A TERRA É REDONDA? NÃO!

É apenas o tamanho do efeito encontrado, o tamanho da diferença observada, que deve (e que pode!!!) ser interpretado!

Cohen, J. 1994. The earth is round (P<0.05). American Psychologist 49: 997-1003

Invited Paper:

THE ROLE OF HYPOTHESIS TESTING IN WILDLIFE SCIENCE

DOUGLAS H. JOHNSON,[1] U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, ND 58401, USA

Abstract: Statistical testing of null hypotheses recently has come under fire in wildlife sciences (Cherry 1998; Johnson 1999; Anderson et al. 2000, 2001). In response to this criticism, Robinson and Wainer (2002) provide some further background information on significance testing; they argue that significance testing in fact is useful in certain situations. I counter by suggesting that such situations rarely arise in our field. I agree with Robinson and Wainer that replication is the key to scientific advancement. I believe, however, that significance testing and resulting *P*-values frequently are confused with issues of replication. Any single study can yield a *P*-value, but only consistent results from truly replicated studies will advance our understanding of the natural world.

JOURNAL OF WILDLIFE MANAGEMENT 66(2):272–276

Key words: effect size, hypothesis test, null hypothesis, replication, significance test.

Biol. Rev. (2007), **82**, pp. 591–605.
doi:10.1111/j.1469-185X.2007.00027.x

Effect size, confidence interval and statistical significance: a practical guide for biologists

Shinichi Nakagawa[1,*] and Innes C. Cuthill[2]

[1] *Department of Animal and Plant Sciences, University of Sheffield, Sheffield S10 2TN, UK* (E-mail: itchyshin@yahoo.co.nz)
[2] *School of Biological Sciences, University of Bristol, Bristol BS8 1UG, UK* (E-mail: i.cuthill@bristol.ac.uk)

(*Received* 2 *January* 2007; *revised* 24 *July* 2007; *accepted* 27 *July* 2007)

ABSTRACT

Null hypothesis significance testing (NHST) is the dominant statistical approach in biology, although it has many, frequently unappreciated, problems. Most importantly, NHST does not provide us with two crucial pieces of information: (1) the magnitude of an effect of interest, and (2) the precision of the estimate of the magnitude of that effect. All biologists should be ultimately interested in biological importance, which may be assessed using the magnitude of an effect, but not its statistical significance. Therefore, we advocate presentation of measures of the magnitude of effects (i.e. effect size statistics) and their confidence intervals (CIs) in all biological journals.

In My Opinion

The need to get the basics right in wildlife field studies

David R. Anderson

tion" (Romesburg 1981, 1989, 1991, 1993). My objective is to focus attention on 2 major problems that seem fundamental to much of what we do in wildlife field studies: 1) the frequent use of convenience sampling and 2) the use of index values (usually raw counts) purporting to measure "relative abundance." These problems result in a lack of

Published in: The Journal of Wildlife Management, Vol. 65, No. 3 (July 2001), pp. 373-378

Invited Paper:

SUGGESTIONS FOR PRESENTING THE RESULTS OF DATA ANALYSES

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WILLIAM A. LINK, U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, MD 20708, USA
DOUGLAS H. JOHNSON, U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, ND 58401, USA
KENNETH P. BURNHAM,[1] Colorado Cooperative Fish and Wildlife Research Unit, Room 201 Wagar Building, Colorado State University, Fort Collins, CO 80523, USA

Abstract: We give suggestions for the presentation of research results from frequentist, information-theoretic, and Bayesian analysis paradigms, followed by several general suggestions. The information-theoretic and Bayesian methods offer alternative approaches to data analysis and inference compared to traditionally used methods. Guidance is lacking on the presentation of results under these alternative procedures and on nontesting aspects of classical frequentist methods of statistical analysis. Null hypothesis testing has come under intense criticism. We recommend less reporting of the results of statistical tests of null hypotheses in cases where the null is surely false anyway, or where the null hypothesis is of little interest to science or management.

JOURNAL OF WILDLIFE MANAGEMENT 65(3):373–378

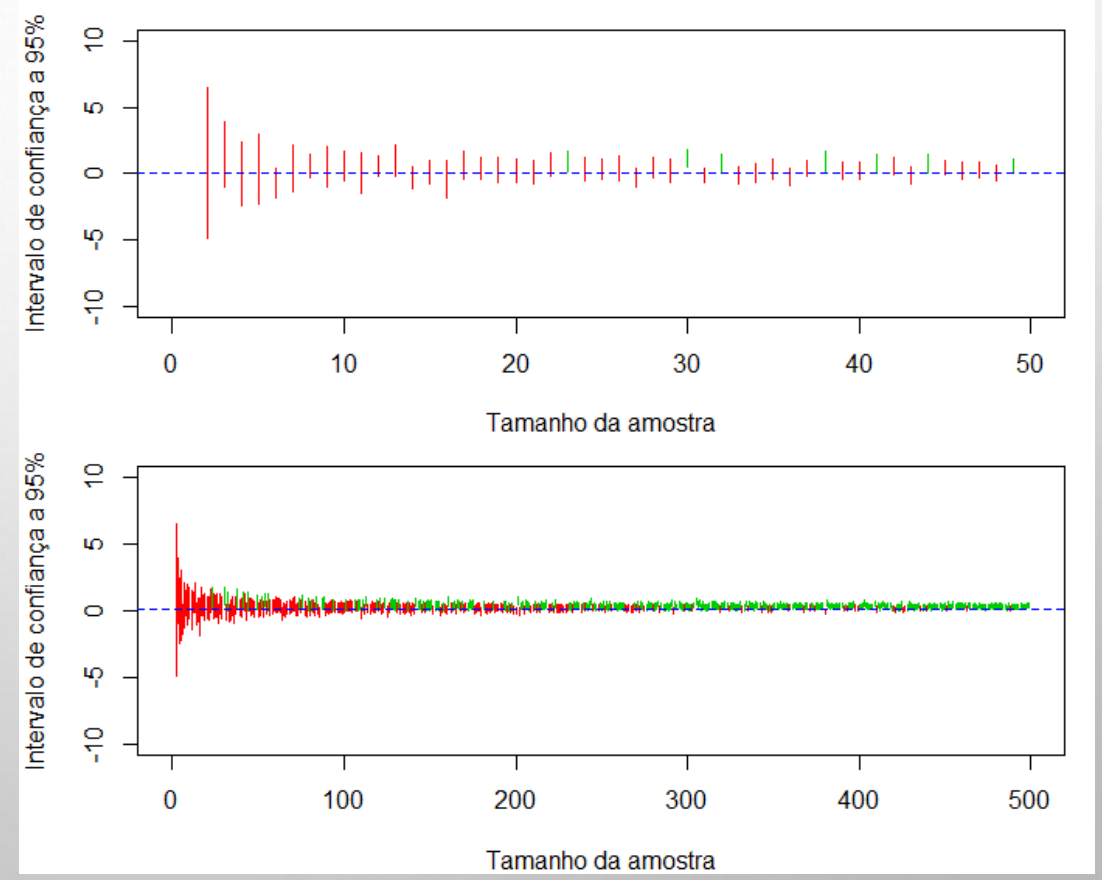
Key words: AIC, Bayesian statistics, frequentist methods, information-theoretic methods, likelihood, publication guidelines.

SIGNIFICÂNCIA: ESTATÍSTICA VS. BIOLÓGICA

- TODA E QUALQUER DIFERENÇA SE TORNA ESTATISTICAMENTE SIGNIFICATIVA DESDE QUE AUMENTEMOS SUFICIENTEMENTE O TAMANHO DA AMOSTRA
- COMO TAL, TODAS AS DIFERENÇAS SERÃO NO LIMITE SIGNIFICATIVAS
- COMO PODEMOS ENTÃO INTERPRETAR UMA DIFERENÇA ESTATISTICAMENTE SIGNIFICATIVA?
- QUAL A MAGNITUDE DO EFEITO OBSERVADO?
- SERÁ BIOLOGICAMENTE RELEVANTE QUE EM MEDIA A ESPÉCIE A PRODUZA 1.32 OVOS E A ESPÉCIE B 1.34 OVOS, MESMO QUE ISSO SEJA ESTATISTICAMENTE SIGNIFICATIVO?

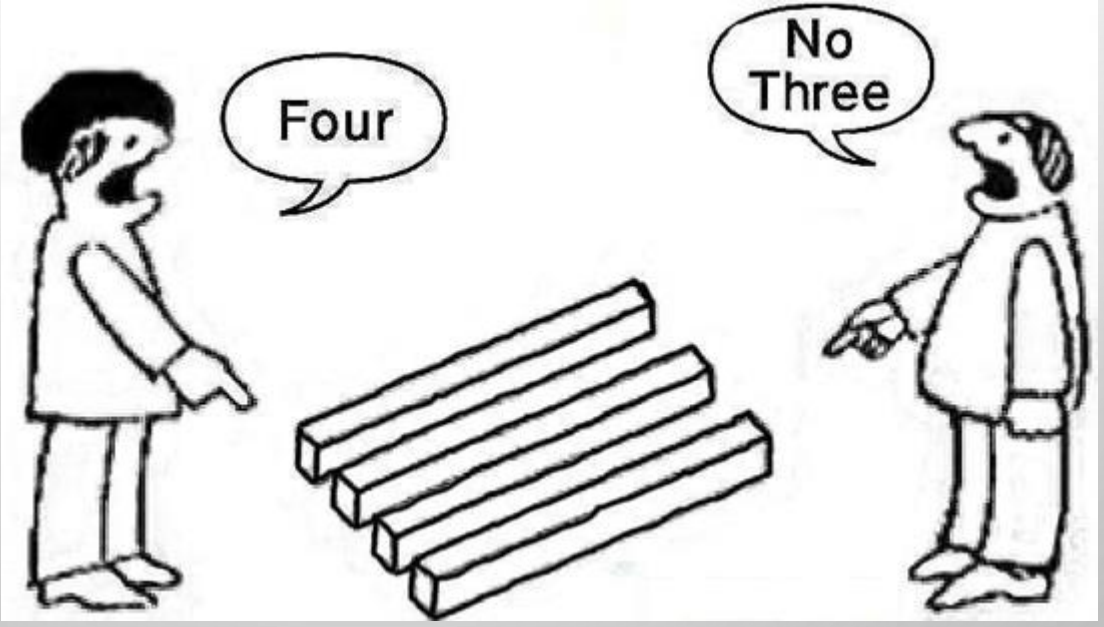
Significância: estatística vs. biológica

- HIPÓTESE NULA: MEDIA É 0
- COM TAMANHO BAIXO DA AMOSTRA, NÃO É FÁCIL REJEITAR
- COM AMOSTRA GRANDE, É RELATIVAMENTE FÁCIL
- (NA REALIDADE, A VERDADEIRA MÉDIA ERA 0.3!)
- À MEDIDA QUE O TAMANHO DA AMOSTRA AUMENTA, CONSEGUIMOS DETECTAR A (VERDADEIRA) DIFERENÇA
- MAS SERÁ BIOLOGICAMENTE



FAZER INFERÊNCIAS SOBRE A REALIDADE

- MAS O QUE É A REALIDADE?



'Truth isn't truth,' says Rudy Giuliani. But nonsense is still nonsense

fonte

Mario Balotelli, playing for Manchester City, is shown a red card during a match against Arsenal.

- TWENTY-NINE TEAMS INVOLVING 61 ANALYSTS USED THE SAME DATA SET TO ADDRESS THE SAME RESEARCH QUESTION: WHETHER SOCCER REFEREES ARE MORE LIKELY TO GIVE RED CARDS TO DARK-SKIN-TONED PLAYERS THAN TO LIGHT-SKIN-TONED PLAYERS.
- ANALYTIC APPROACHES VARIED WIDELY ACROSS THE TEAMS
- TWENTY TEAMS (69%) FOUND A STATISTICALLY SIGNIFICANT POSITIVE EFFECT, AND 9 TEAMS (31%) DID NOT OBSERVE A SIGNIFICANT RELATIONSHIP.

Silberzahn *et al*. (2018). Many Analysts, One Data Set: Making Transparent How Variations in Analytic Choices Affect Results. Advances in Methods and Practices in Psychological Science. DOI: https://doi.org/10.1177/2515245917747646

WHAT IS REALITY…?

- A SINGLE RESPONSE (ACORN COUNT), THREE DESIGNED EFFECTS (SPECIES, SITE, AND YEAR) AND 7 ENVIRONMENTAL VARIABLES
- "EXPLAIN THE VARIATION IN THE RESPONSE VARIABLE (ACORN COUNT) USING THE PREDICTORS AVAILABLE"
- RESPONSES FROM A SKILLED AVERAGE SELF-REPORTED STATISTICAL EXPERTISE OF 6.7 ON SCALE OF 1 [LOW] TO 10 [HIGH]) DIVERSE GROUP OF 24 ECOLOGISTS
- NO TWO FINAL MODELS INCLUDED EXACTLY THE SAME SET OF PREDICTORS
- NOT A SINGLE PREDICTOR WAS INCLUDED IN EVERY FINAL MODEL

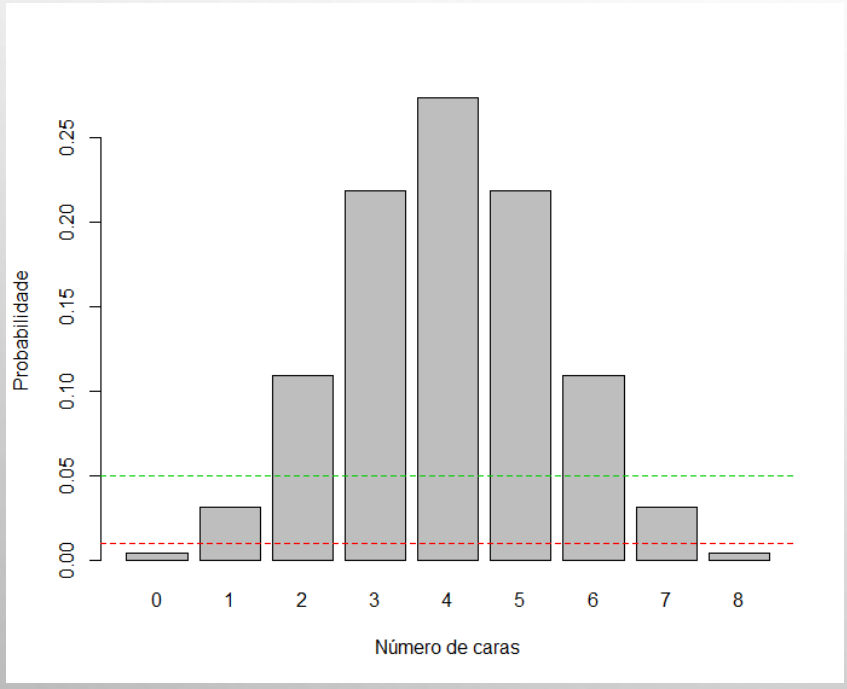
Stanton-Geddes et al. 2014. In defense of P values: comment on the statistical methods actually used by ecologists. Ecology 95: 637--642

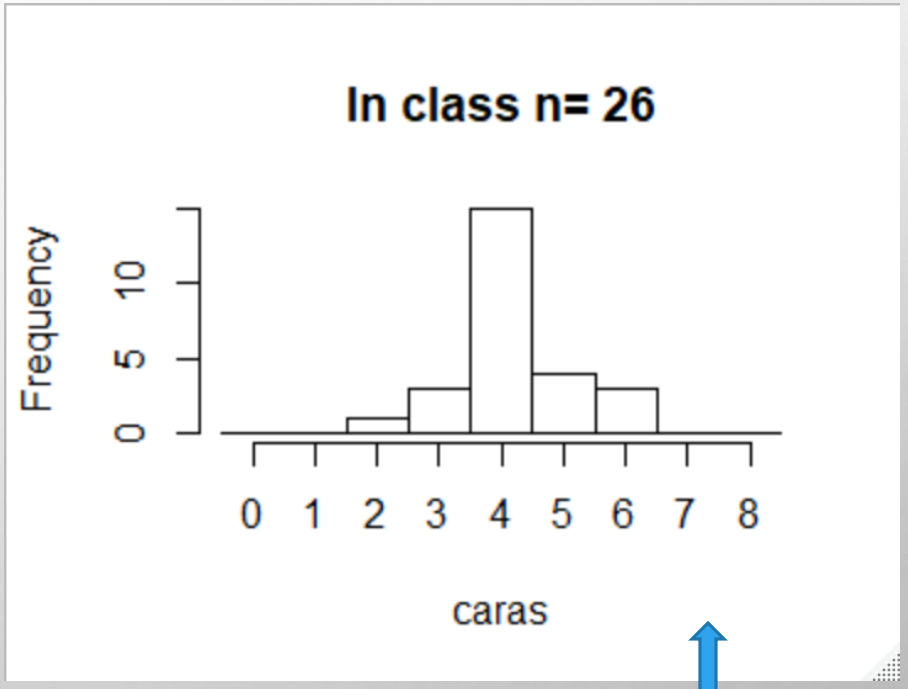
COMO AVALIAR SE ALGO QUE OBSERVAMOS PODE SER MAIS DO QUE FRUTO DO ACASO?

- PRIMEIRO HÁ QUE DEFINIR O QUE ENTENDEMOS POR ACASO
- QUAL A HIPÓTESE NULA QUE ASSUMIMOS?
  - AS ÁRVORES DO LOCAL A SÃO IGUAIS EM TAMANHO ÀS DO LOCAL B
  - A TEMPERATURA NÃO INFLUENCIA O CRESCIMENTO DOS ANIMAIS
  - A MINHA MOEDA NÃO ESTÁ VICIADA
- DEPOIS RECOLHEMOS DADOS QUE CONTENHAM INFORMAÇÃO RELEVANTE SOBRE A HIPÓTESE FORMULADA
- POR FIM REJEITAMOS, OU NÃO, A HIPÓTESE COLOCADA

SE EU LANÇAR UMA MOEDA E TIRAR 8 COROAS SEGUIDAS, A MINHA MOEDA É VICIADA?

Distribuição teórica (+-=milhões de vezes)





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hist(caras,breaks=-1:8,xaxt="n",main=paste("In class n=",length(caras))) > axis(1,(0:8)-0.5,0:8)

EXERCÍCIO: LANÇAR UMA MOEDA AO AR 8 VEZES, E CONTAR O NÚMERO DE CARAS

- O NÚMERO DE CARAS É UMA "VARIÁVEL ALEATÓRIA" (CADA PESSOA OBTÉM UM NÚMERO, DESCONHECIDO À PARTIDA, MAS SABEMOS SEM DUVIDA QUAIS SÃO OS NÚMEROS POSSÍVEIS DE OBSERVAR)
- PODEMOS COMPARAR COM O NÚMERO DE CARAS OBTIDO COM O QUE SERIA DE ESPERAR, E TIRAR CONCLUSÕES
- CADA PESSOA OBTÉM UM RESULTADO
- MAS A REALIDADE É SÓ UMA: AS MOEDAS NÃO SÃO VICIADAS (ESPERO EU!)

LET'S GO TO R

HOMEWORK - TPC

TPC: TRABALHO PARA CASA

- EM GRUPOS DE 3 ALUNOS (TALVEZ SEJA MAIS SIMPLES MANTEREM-SE DENTRO DOS VOSSOS MESTRADOS, BC'S COM BC'S, EGA'S COM EGA'S, EM'S COM EM'S?)
- RECOLHER UM CONJUNTO DE DADOS "ECOLÓGICOS", COM UM TAMANHO DE AMOSTRA PELO MENOS IGUAL A 30, IDEALMENTE MAIOR QUE 50
- FORMULAR UMA PERGUNTA ECOLÓGICA
- REGISTAR (PELO MENOS) DUAS VARIÁVEIS, IDEALMENTE MAIS, QUE POSSAM SER COMPARADAS, E UMA VARIÁVEL QUE POSSA SER "RELACIONADA COM AS" / "MODELADA EM FUNÇÃO DAS" ANTERIORES
- EXEMPLOS:
  - SELECIONAR 50 ÁRVORES. MEDIR A LARGURA DE 2 FOLHAS, UMA MAIS BAIXA E UMA MAIS ALTA, EM CADA ÁRVORE, E O DAP (DIÂMETRO À ALTURA DO PEITO) DE CADA ÁRVORE
  - SELECIONAR 50 PLANTAS COM FLORES. MEDIR A ALTURA AO SOLO DA PLANTA. SELECIONAR A FLOR MAIS ALTA E A MAIS BAIXA. CONTAR QUANTOS INSETOS HÁ EM CADA UMA DAS FLORES.
  - SELECIONAR 50 POMBOS. REGISTAR SE É MACHO OU FÊMEA. REGISTAR SE ESTÁ SÓ OU ACOMPANHADO. ANDAR EM DIREÇÃO A CADA POMBO E REGISTAR A DISTÂNCIA A QUE ELE "PARA E OLHA" PARA AVALIAR O PERIGO E A DISTÂNCIA A QUE ELE "FOGE".

TPC: TRABALHO PARA CASA

Com base nos dados, criar um pequeno relatório dinâmico em que a resposta à pergunta original seja abordada – (por enquanto fazem porque eu digo que sim… mas… poderá vir a ser uma componente de avaliação! Lembrete: a decidir na próxima aula)