|---------+--------------------------->
	Joseph Skorupa
	12/02/2004 08:51
	AM
---------+--------------------------->
  >---
---|
  |
|
  | To: "Anthony Toto" <atoto@waterboards.ca.gov>
|
  | cc: Steven Detwiler/SAC/R1/FWS/DOI@FWS, Thomas
Maurer/SAC/R1/FWS/DOI@FWS, Joy Winckel/SAC/R1/FWS/DOI@FWS,
William|
  | Beckon/SAC/R1/FWS/DOI@FWS, Daniel
Russell/SAC/R1/FWS/DOI@FWS, jvance@water.ca.gov
|
  | Subject: Re: Panoche 2003 Egg Chemistry(Document link: Joy
Winckel) |
  >---
---|

Anthony,

In summary, in the absence of nest monitoring data, our best approach is to
project expected adverse effects from the data on egg chemistry. I have
done that below for the endpoint of teratogenesis (embryo deformities) in
black-necked stilts using very reliable and precise species-specific data
for black-necked stilts collected primarily within the San Joaquin Valley.
Thus, my projections are made from data that are both species- and
site-specific. The results indicate that for the flooded pasture we would
have expected about 25% of all the stilt eggs laid to contain embryos that
would have been deformed if they developed to full term. That's rougly

4-times the frequency of embryo deformities in black-necked stilts that was documented for Kesterson Reservoir in the 1980's. As a general rule of thumb, based on laboratory data for mallards, and field data from Kesterson for a broad array of species (including black-necked stilts), total frequency of failed eggs (including embryo death without deformity) is usually ca. 30% in addition to the rate of teratogenesis. So in this case, ca. 25% teratogenesis + ca. 30% non-teratogenic embryo death would lead to a best-estimate expectation of somewhere around 50% total Se-caused embryo mortality.

The risk projections summarized above are based on the selenium concentrations in the five randomly sampled black-necked stilt eggs from the flooded pasture which contained a geometric mean of 46 ppm (rounded to the nearest whole ppm). However, for the larger full sample of recurvirostrid eggs collected from the flooded pasture (N=14; 5 stilt eggs + 9 avocet eggs) the geometric mean selenium concentration was 58 ppm. Thus, 58 ppm Se would be a better measure of the mean exposure for all stilts breeding at the flooded pasture (stilts and avocets are usually interchangeable for estimates of exposure, but not for estimates of effects from that exposure). That level of mean exposure, i.e., 58 ppm, is the same as documented for black-necked stilt eggs at Red Rock Ranch in 1996. In the case of Red Rock Ranch during 1996, the fate of every stilt egg (N=36) was documented. There was a 57% rate of embryo deformity, and an overall 67% rate of embryo death (i.e., 24 of 36 eggs contained dead embryos, 17 of which were also deformed; the deformity status for 6 eggs could not be determined, thus the observed deformity rate was 17 of 30, not 17 of 36).

I have focused on black-necked stilts because they are roughly twice as sensitive to selenium than are American avocets and therefore are a better indicator species for adverse effects (i.e., they provide an earlier warning of problems).

Conclusions: Beyond any reasonable statistical doubt, the accidental flooding of the Panoche pasture during April/May 2003 caused "take" of black-necked stilts as defined by the MBTA. The level of impact that likely occurred to the nesting stilts at the flooded pasture would have been severe (50% embryo mortality or greater). The failure of the monitoring program to document such adverse effects can be attributed to the program's failure to collect stilt eggs that had been incubated long enough (> one week) to contain developed embryos, or to monitor the fate of uncollected stilt eggs, or to collect fail-to-hatch stilt eggs. Clearly, exactly how the water for this Panoche WD project is managed will be crucial for controlling environmental impacts of the project, with apparently very small margin for error.

For details of the stilt risk calculations see below:

Based on my most recent logistic regression run for the exposure-response relationship for Se and Black-necked Stilts (November, 2001, run; based on 931 data points; using only random samples) the five stilt eggs that HT Harvey collected from the Panoche flooded pasture in 2003 would have had the following expected probabilities of containing deformed embryos:

Egg 1 w/ 50 ppm Se; prob. = 0.297

Egg 2 w/ 33 ppm Se; prob. = 0.056

Egg 3 w/ 41 ppm Se; prob. = 0.130

Egg 4 w/ 50 ppm Se; prob. = 0.297

Egg 5 w/ 59 ppm Se; prob. = 0.545

Cumulative probability of teratogenesis for the five eggs is: 1.325

Thus, the expected overall rate of teratogenesis for this population would have been (1.325/5.0) = 0.265; 26.5% [for comparison, the rate of teratogenesis among stilts nesting at Kesterson Reservoir was about 6%... so we're talking about an expected rate of impact at about 4 times worse than Kesterson].

Given the selenium concentrations of the five sample eggs, if those specific five eggs had all contained assessable embryos (in reality all five were collected as early stage unassessable eggs), there would have been about an 82% chance that at least one of the sample eggs would have contained a deformed embryo.

If all of these sample eggs came from clutches of 4 eggs, thus representing a population of 20 total eggs (five nests times four eggs each), and if the chemistry of the sample eggs was representative of the total population, then there was a 99.8% chance that at least one of the 20 eggs would have produced a deformed embryo (assuming that embryo assessments could have been obtained for all 20 eggs). If the population of stilt nests at the flooded pasture consisted of more than just the five nests that were sampled, then the probability of at least one deformed embryo would have been even greater than 99.8%. Even at 99.8%, we're looking at a virtual certainty; there are only 2 chances in 1,000 that 20 eggs at this level of contamination would not produce a deformed embryo.

To sum up... for a population of 20 eggs exhibiting the level of exposure
to Se that was documented for the flooded pasture, we would expect on
average about 5 of the 20 embryos to be deformed (26.5% = 5.3), with a
probability of greater than 99% of at least 1 deformed embryo.

Best Regards,

Joe

Joseph P. Skorupa, PhD
Clean Water Act Biologist
Environmental Contaminants Branch
Division of Environmental Quality
U.S. Fish and Wildlife Service
4401 N. Fairfax Drive, Rm. 322
Arlington, VA 22203

ph: (703)-358-2402
fax:(703)-358-1800
e-mail: joseph_skorupa@fws.gov

|---------+------------------------->
	"Anthony Toto"
	<atoto@waterboar
	ds.ca.gov>
	12/01/2004 06:57
	PM
---------+------------------------->
  >---
---|
  |
|

| To: <Joseph_Skorupa@fws.gov>, <Steven_Detwiler@fws.gov> |
| cc: <Joy_Winckel@fws.gov>, <Thomas_Maurer@fws.gov> |
| Subject: Re: Panoche 2003 Egg Chemistry |
>----------|

NO Problem at all... I just want to make sure I am not speaking out of turn... Basically my thoughts are the selenium levles are elevated, no deformities were found but by the same token eggs were not old enough to
access.... In a nutshell thats what I was going to report. This report was sent to Gail Cismosky of our sacramento staff and she asked for my
opinion today. I thought I best bounce it off of y'all before I said anything.

Thanx for your input... if I have further questions I will be sure to let you know.

Happy Holidays

EFFECTIVE 10 November 2004
NEW EMAIL ADDRESS
atoto@waterboards.ca.gov

Anthony L. Toto
CA Regional Water Quality Control Board
1685 E Street
Fresno, CA 93706-2007
(559) 445-6278
(559) 445-5910 FAX

Joseph Skorupa
12/01/2004 02:43 PM

To: "Anthony Toto" <atoto@waterboards.ca.gov>
cc: Thomas Maurer/SAC/R1/FWS/DOI@FWS, Steven

Detwiler/SAC/R1/FWS/DOI@FWS, Joy Winckel/SAC/R1/FWS/DOI@FWS

Subject: Re: Panoche 2003 Egg Chemistry

Anthony,

Artificial incubation is a very viable way to produce assessable embryos, especially for stilt and avocet eggs (i.e., those species of eggs incubate quite robustly). Detwiler and I have used that method repeatedly in various studies. Most recently (2003), I artificially incubated Killdeer eggs from that Cotton Gin site on Mt. Whitney (?) Avenue (in WWD) in order to get assessable embryos (which yielded classic Se-deformed embryos, not surprising since the eggs contained >100 ppm Se, that I wouldn't otherwise have been able to document). It is a valuable technique when you want to pre-empt losing the eggs to predators (which is the most common cause for failure to collect assessable embryos, i.e., predators are eating the eggs before any of them get far enough along in natural incubation to contain assessable embryos). Where egg predation rates in the field are low, it is a simple matter to collect assessable embryos. You simply don't collect the egg until it "floats" (a field technique for roughly aging the egg) at an angle indicating that it has a well developed embryo inside (over the years that has been standard procedure in the vast majority of field work I have been involved with, we always attempt to maximize the data we get from each egg we collect... which means only collecting late-stage eggs when you have that luxury... i.e., are reasonably confident the eggs will still be there on a subsequent visit to the nest if you defer collecting until later, and you in fact have the option of returning to the study site later... sometimes you know you only have one visit to collect eggs and in that case you take whatever age eggs you can get on that one visit... that's why even our databases include some early-stage unassessable eggs).

I am copying this response to the Sacramento FWS folks because with regard

to an agency review of the Panoche report that is something that they should be in the loop on. Maybe they've already done it, or have plans to
do it? If not, I have no objection to providing you with a more formal version, appropriate for sharing w/ WQ staff, of the material in the e-mails I shared with you. Work this out with Sacramento FWS folks and
everyone just let me know what you decide.

Best Regards,

Joe

"Anthony Toto" <atoto@waterboards.ca.gov>
12/01/2004 04:46 PM

To: <Joseph_Skorupa@fws.gov>
cc:
Subject: Re: Panoche 2003 Egg Chemistry

From a non-biologist perspective - When an egg is collected in the field.
Can the egg be incubated to the stage of an assessable embryo? Are there
methods to age the egg and then allow it to develop to a point where a determination can be made as to whether there is a deformity or not? Or
am I being naive?

Seems to me there should not be any unacessable embryos.... am I way off
base? I am thinkin that once the egg is laid all it needs is warmth or is that a poor assumption?

Is there a "agency" review of the report that I might share with Sacramento WQ staff? or if you wouldnt mind cutting and pasting portions

of your emails that you are comfortable sharing w. other RB staff.

EFFECTIVE 10 November 2004
NEW EMAIL ADDRESS
atoto@waterboards.ca.gov

Anthony L. Toto
CA Regional Water Quality Control Board
1685 E Street
Fresno, CA 93706-2007
(559) 445-6278
(559) 445-5910 FAX