

A Review of

Final Report: “Benefits Valuation Study for Diablo Canyon Power Plant,” prepared for PG&E by Matthew Bingham et al, Triangle Economic Research, February 21, 2005

by

Prof. Charles D. Kolstad¹

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¹ For identification only: Bren School of Environmental Science & Management, University of California, Santa Barbara. Email: ckolstad@sbceo.org. Website: <http://www.ckolstad.org>.

1 INTRODUCTION.

2 The subject report from Triangle Economic Research (referred to here as “TER
3 Report” or “TER Analysis”) presents an estimate of the economic benefits of reducing
4 impingement and entrainment (I&E) losses of marine life in the cooling water intake
5 system at Diablo Canyon Power Plant (DCPP), pursuant to procedures in Section 316(b)
6 of the Clean Water Act and its implementing regulations.

7 In particular, the regulations allow a site-specific determination of “best
8 technology available” for mitigating adverse effects of I&E. One option for obtaining
9 such a determination is to develop a cost-benefit analysis of I&E reduction. Such an
10 analysis must be supported by a benefits valuation study (as well as other supporting
11 analyses not considered here). The TER Report constitutes the benefits valuation study
12 required under Section 316(b).

13 Although the estimate of benefits must stand on its own two feet, there is a
14 significant amount of guidance that the EPA has provided in preparing the benefits study.
15 Specifically, in part because EPA must conduct it’s own benefit-cost analysis of the
16 proposed regulation, the EPA has conducted its own estimate of benefits in California.
17 Furthermore, in its Federal Register publication of Final Regulations (July 9, 2004), the
18 EPA provides considerable insight into its conclusions regarding how a benefits study in
19 this context should be conducted – what steps are reasonable and what steps are not.

20 The TER analysis is based on the premise that marine life lost (due to water
21 intake at DCPP) has direct and indirect use-based impacts on commercial fisheries and
22 recreational fisheries. The authors also consider non-use losses but in the end conclude

1 that non-use losses are negligible. The authors also conduct an analysis of the effect of
2 uncertainty on their conclusions.

3 Several caveats regarding this review of the TER Report are in order. One is that
4 just because EPA does something in its own analysis² of the 316(b) rules does not
5 necessarily mean that the EPA approach is economically correct or consistent with “best
6 practice” in economics (though for the most part, the EPA analyses are very good).
7 Another caveat is that I have assumed the biologic components of the TER analysis are
8 correct -- this reviewer is not a biologist. Having said this, the TER work does seem to
9 parallel EPA’s own biologic analysis done in support of the 316(b) rules.

10 One of the TER authors’ general conclusion is that eliminating all losses from
11 I&E at DCPD would have an annual benefit of \$26,000 to \$49,000. Converting a stream
12 of these annual losses (through 2053) into a net present value yields \$563,000 to
13 \$1,035,000 (with smaller numbers for a shorter period or less complete elimination of
14 I&E losses).

15 In general the TER analysis is competently done, to a large extent paralleling the
16 analyses of I&E in California done by the EPA.³ This is not to say the report is perfect;
17 however, it is unlikely (though always possible) that addressing the criticisms in this
18 review will result in dramatic changes in the conclusions.

19

² “Economic Benefits Analysis for the Proposed Section 316(b) Phase II Existing Facilities Rule,” EPA Report EPA-821-R-02-001 (February 2002); and “Economic Benefits Analysis for the Final Section 316(b) Phase II Existing Facilities Rule,” EPA Report EPA-821-R-04-005 (February 2004).

³ The California analyses are in the same reports as the general analysis of the 316(b) Phase II Existing Facilities rules: EPA Report EPA-821-R-02-001 (February 2002) and EPA Report EPA-821-R-04-005 (February 2004).

1 GENERAL COMMENTS

2 These general comments parallel the specific questions in the Peer Review
3 Charge. Each of the points raised here is further elaborated in the subsequent section on
4 Specific Comments.

5 1. Is the organization of the report appropriate and does it present the material in
6 a clear and concise manner? Are there any changes that are recommended?

7 The organization of the report is good; the report is easy to follow. My primary
8 suggestion for revision would be to tighten up the presentation, more completely
9 documenting assumptions. There is an informality of presentation that makes it difficult
10 to check some assumptions made by the authors. The report should be written in such a
11 way that a reader can go directly to important data sources and even so a third party could
12 reproduce the analysis.

13 2. Is the report consistent with economic principles of measuring benefits? Are
14 there any changes that would make it more consistent with accepted economic principles?

15 To a very large extent, the economics used in the report is good. As will be
16 discussed below, some of the background discussion of fisheries and welfare do not
17 appear to be correct; however, the background discussion is not pivotal to the analysis.
18 Another problem has to do with how commercial benefits are calculated. There are other
19 modest issues that will be raised in the next section on specific comments.

20 3. Is the report consistent with the EPA Phase II 316(b) regulations for measuring
21 benefits? Are there any changes that would make it more consistent?. The authors are
22 careful to parallel the EPA analyses closely in preparing the DCPD assessment. From my
23 reading of the EPA requirements, the authors have met the requirements. Perhaps the one

1 area with which I have some concern is non-use benefits. It would appear from the EPA
2 regulations that only a qualitative discussion of non-use benefits is required, which is
3 what TER provides. However the TER qualitative discussion is short and in my opinion
4 could be strengthened. This is not to say they have not met the EPA requirements, only
5 that there is room for improvement.

6 4. Are the potential economic effects of I&E addressed in a manner consistent
7 with standard principles and practices for conducting benefits studies? All potentially
8 important beneficial effects of I&E reduction appear to be included in the analysis. The
9 authors correctly mention the secondary effects on fishing effort from a larger stock but
10 do not include it in their analysis (nor does EPA). This effect is likely to be negligible. I
11 have some concerns with the methodology of the commercial benefits calculation and
12 some other minor concerns; all are detailed in the specific comments part of this review.

13 5. Are all of the relevant benefit categories included in the analysis? Are any
14 significant categories omitted? If there are omitted categories, what methods could be
15 used to reliably assess their value? All relevant categories of impacts appear to be
16 included in the TER analysis. As mentioned above, I have some concern about the
17 completeness of the non-use benefits discussion; however, that category of benefit is not
18 omitted from the analysis.

19 6. Are potential nonuse benefits addressed in a way that is consistent with
20 economic principles and benefits practices? Are they addressed consistent with the EPA
21 Phase II 316(b) regulations? Are any changes necessary? Nonuse benefits appear to be
22 handled consistent with EPA regulations in that the regulations appear to only require a
23 qualitative discussion of these benefits. I believe the qualitative discussion could be

1 strengthened somewhat though that is unlikely to change the conclusions. I would not
2 say that the nonuse benefits are addressed in a manner consistent with best economic
3 principles. This would require a more extensive analysis than is found here. But since
4 that is not required by the EPA, I see no reason to do it.

5 7. Is the empirical analysis consistent with standard statistical and econometric
6 procedures? Specifically, are the data appropriate for the task or could better data have
7 been used? Are the benefit calculations performed in a manner that is consistent with
8 standard economic practices? Are there improvements that should have been
9 implemented? Although there are small issues which I detail below, the empirical
10 analysis is generally good. I think it is unfortunate that the RUM analysis that the TER
11 report relies upon is unpublished; peer-reviewed and published work is the ideal.
12 Furthermore, the TER authors were unable to develop a model to show how increased
13 catch rates will increase recreational fishing. The reason given for omitting this from the
14 TER report is that EPA didn't do it for California, which is not necessarily a valid excuse.
15 Finally, the assumption of unitary elasticity of demand for fish in the commercial demand
16 section is not supported; in fact, the commercial benefits section may be flawed.

17 8. Is the uncertainty analysis consistent with standard statistical principles and
18 practices? Have the relevant sources of uncertainty been accounted for? Have the
19 appropriate confidence intervals and other statistical principles been calculated and used
20 in the appropriate manner? Are there any improvements that should be implemented?

21 The uncertainty analysis could be improved. Some sources of uncertainty (such as non-
22 use value) are omitted in favor of uncertainty with respect to a limited set of parameters.
23 The use of ranges instead of standard errors is not explained well and is not ideal. There

1 is nothing wrong with what has been done except that the approach probably understates
2 uncertainty. Furthermore, many of the biologic parameters are undoubtedly correlated,
3 which will affect the results of the analysis.

4 9. Does the study provide a reliable estimate of the potential benefits of reducing
5 I&E impacts at DCP? If so, why so? If not, would it be reliable if the proposed
6 changes you have recommended were implemented in appropriate fashion? My opinion
7 is that the authors have included the most important benefits categories in their analysis.
8 Furthermore, I expect that if they addressed all of the concerns raised here the qualitative
9 conclusions of the analysis would not be substantially changed. I would expect the
10 uncertainty in the bottom line to increase somewhat.

11

12 SPECIFIC COMMENTS.

13 These specific comments correspond to the specific sections of the report.

14 Section 2. Background. Generally, the background section is accurate.

15 However, there is a discussion of fishery markets in section 2.4 (pp 9-10) which is not
16 really accurate or at best, incomplete. The authors discuss the welfare economics of a
17 fishery in the same way they would any commodity market. The important complicating
18 factor in a fishery is *access*. If the fishery is *open access* (unregulated), there is no
19 surplus or rent accruing to producers – the cost of fishing equals revenue. There may still
20 be an upward sloping supply curve but the area between the price and the supply curve is
21 not generally producer surplus (including rent). If the authors are distinguishing between
22 rent and producer surplus, that should be made more explicit. On the other hand, if the
23 fishery is efficiently regulated, then there are rents that accrue, possibly to the producer.

1 Producer surplus is a more complex issue than in standard markets. This is one reason
2 the EPA⁴ assumes that producer surplus is 0%-40% of gross revenues (based on the
3 literature) rather than actually measuring it.

4 I would like to see the discussion qualified; it is probably not necessary to launch
5 into a full discussion of fishery economics, in part because EPA does a good job of this in
6 their report. The consumer surplus discussion is fine but there really should be a
7 discussion of the nature of regulation (or absence thereof), particularly in the vicinity of
8 DCP, and how it affects producer surplus and rents. The effect of I&E losses on an
9 open access fishery will be quite different from an efficient fishery which will be quite
10 different from a partially regulated fishery.

11 In section 2.5, several documents are mentioned (the two California studies and
12 the ASA prior study). These should be completely referenced in such a way that the
13 reader can access the documents. This comment applies in many parts of the TER report.
14 If the authors are relying on an analysis or piece of data, the source should be fully
15 referenced.

16 Section 3.1 Description of Valuation Methodologies. This is a well-written and
17 clear section. I do have some issues however with recreational as well as commercial
18 valuation.

19 The worked-through example of the Brown Rock Crab is a nice addition to the
20 report. The TER authors should try to document the example sufficiently so that
21 someone could duplicate the analysis. This is not done. For instance, in Step 4 (p 24), it
22 is approximately clear where the 75:25 split came from but it is not easy to find the
23 appropriate data on the California Department of Fish and Game website.

⁴ Section A10-11 of EPA Report EPA-821-R-04-005 (February 2004).

1 Recreational Values. Step 5 of section 3.1.1 (p 17) concerns the recreational
2 valuation component. The TER report uses a Random Utility Model (RUM) of
3 recreational fishing to estimate the benefits per fishing day of an increase in the catch
4 rate. The TER authors use the parameters from the RUM developed by EPA for the
5 California regional analyses (a sensible step). But EPA recommends a second step,
6 calculation of increased trip frequency from increased catch. This turns out to be
7 significant in other regions⁵ though EPA was unable to estimate such a participation
8 model for California. TER neglects this second step, perhaps for good reason. I would
9 like to see this explicitly accounted for in the analysis. TER should include either a
10 treatment of participation or a rationale for why it is omitted.

11 Commercial Values. The authors of the TER analysis take an approach to
12 commercial benefits that is different from the approach of the EPA and actually quite
13 innovative. TER assumes a downward sloping demand curve for fish/shellfish which
14 implies that decreased I&E has an effect on the price of fish with consequent effects on
15 consumer surplus from this change. Because of the assumptions TER makes, they do not
16 even have to consider changes in producer surplus. This is in contrast to EPA, which
17 ignores changes in consumer surplus in favor of changes in producer surplus. Although
18 TER's approach is innovative, it may not be correct.

19 One of the problems of evaluating effects on a fishery is what to do with producer
20 surplus. As mentioned earlier, if the fishery is open access, there will be no rents and
21 probably no producer surplus. If we perfectly represent the way in which the fishery is
22 regulated, then we may be able to actually compute the surplus accruing to producers.

⁵ EPA Report EPA-821-R-04-005 (Feb, 2004), Part D, Chapter D-4.

1 The EPA takes the approach of assuming a certain percentage of gross revenues is
2 producer surplus (based on studies by others).

3 In the TER Report, the authors assume that the price elasticity of demand for a
4 particular species is -1. It happens that for demand curves with price elasticities of -1,
5 revenue is the same no matter what the price. Thus the TER authors effectively constrain
6 gross revenue to be constant as supply changes. If producer surplus is some fraction of
7 gross revenue then no change in gross revenue implies no change in producer surplus.
8 This assumption allows TER to focus on consumer surplus and not worry about producer
9 surplus.

10 Mathematically, this is convenient and correct. But is it an accurate
11 representation of the markets in question? The TER authors simply assume the demand
12 elasticity is -1, rather than concluding it is -1. They should at minimum provide some
13 support for this. Furthermore, it is not clear what the geographic market is that they are
14 working with – the local market, the California market or something larger? The smaller
15 the market, the more elastic the demand is. There are numerous studies of the demand
16 elasticity for fish and seafood. However, if the affected market is part of a much bigger
17 market, then it is unlikely the increased supply from reduction in I&E will have much
18 effect on price. In fact, EPA assumes that decreased I&E will not affect the price.⁶ There
19 probably is a geographic market for which the price elasticity of demand is -1 but we
20 would need to know what that market is before applying the approach outlined by TER.

21 The significance of this assumption is illustrated in the Brown Rock Crab
22 example (p. 25). The example shows that the additional surplus from avoided I&E
23 comes from the reduction in the price of crab. For other species, the effect on price is

⁶ Refer to section A10-11 of EPA Report EPA-821-R-04-005 (February 2004).

1 probably much lower (though maybe not -- the data are not provided) and thus the
2 surplus gain very low. If on the other hand, demand were more elastic (and thus price
3 stayed more constant), the revenues would rise from reduced I&E and a portion of the
4 producer surplus would be counted as a benefit.

5 The bottom line is that the TER authors take a different approach from the EPA in
6 valuing commercial benefits from reduced I&E and do not sufficiently support the
7 validity of their approach. My recommendation would be to either more fully support
8 their analysis or adopt an approach more similar to what has been done by EPA.
9 However, it should be pointed out tht according to TER's figures at the top of p18, the
10 significance of this error may not be great.

11 Indirect Effects. In footnote 18 on the bottom of page 18, the authors should
12 mention other indirect effects, including those that are excluded – such as the stock effect
13 that makes fishing easier (as discussed in the Background section).

14 Section 3.2 Analysis of the Effects of Uncertainty. The uncertainty analysis
15 appears methodologically correct. My primary suggestions have to do with
16 documentation and specific assumptions about uncertainty.

17 According to the description of the uncertainty analysis in section 3.2 (p 26), most
18 parameter uncertainty appears to be represented by a range of values around a central
19 tendency. The authors should point out that this amounts to assuming a uniform
20 distribution over a range rather than a distribution that looks like the examples in Figure
21 6. There is nothing wrong with using a uniform distribution (though it may not always be
22 appropriate) but the discussion should be clear. Furthermore, the focus on parameter
23 uncertainty is a bit narrow. Not only are the ranges of uncertainty detailed in Appendix B

1 sometimes very small (for example, recreational values are $\pm 2.5\%$) but not all parameter
2 uncertainty is represented. The uncertain parameters of the RUM induce uncertainty in
3 the recreational value estimates; non-use value estimates are surely very uncertain.

4 I would suggest the authors move away from a uniform distribution of
5 uncertainty, at least in some cases, and also move to including more variables with a
6 wider range of uncertainty. Moving away from the uniform should reduce the spread of
7 results; including more variables with wider ranges of uncertainty will increase the
8 spread. A look at Table 3 illustrates that the underlying parameter uncertainty does not
9 induce a very large spread in final benefits figures.

10 The uncertainty section relies on Appendix B, which could be improved. It is
11 difficult to understand what is being done from the discussion in the Appendix. The
12 concept of “range” is never defined, though I suspect it is $\pm x\%$. Footnote 39 is not too
13 helpful. The method for obtaining the ranges is also not well explained. Table B.2 uses
14 standard deviation. How does that connect to range?

15 Section 3.3 Results. Table 5 on p 31 is very helpful in that it is an attempt to
16 show how the results of the TER analysis compare to other analyses (specifically the
17 EPA California studies). This is a nice addition to the report. However, I would prefer to
18 see this table fleshed out a little more so that a comparison is easier. About the only thing
19 a reader can do is divide the benefits numbers by the number of facilities and compare.
20 Using that approach, the TER figure is quite a bit smaller than the other studies. Perhaps
21 there is a better way of comparing?

22 Section 4 Non-use Values. Non-use values are always tough to estimate, as is
23 made clear by both the EPA and TER. Because of the uncertainty in this arena, EPA has

1 generated specific guidelines regarding when a monetization of non-use benefits is
2 needed. Although I am not convinced that there are no non-use benefits of I&E
3 reduction, it does appear that TER is following EPA's guidelines in concluding that a
4 qualitative discussion of these impacts is all that is needed.

5 I see two different discussions of non-use benefits in the lengthy Federal Register
6 report on the final 316(b) rule. One pertains to what EPA is relying on for their national
7 cost-benefit analysis of the rule. The other pertains to what should be included in
8 benefits assessments in support of site-specific best available control technology. This
9 section of the TER Report is a little confusing to the reader and the TER authors may
10 wish to clarify this. For instance, EPA concludes (quoted by TER on p32) that "none of
11 the methods it considered for assessing nonuse benefits provided results that were
12 appropriate to include in this final rule, and has thus decided to rely on a qualitative
13 discussion of nonuse benefits." This does not mean that qualitative discussion of nonuse
14 benefits is always adequate for site-specific benefits assessments, as is made clear on
15 page 41648 of the Federal Register (July 8, 2004) and quoted by TER on p37.

16 Although I have not examined the "impingement mortality and entrainment
17 characterization study" -- the TWG I&E study -- I assume that it did not identify I&E as
18 resulting in substantial harm to a threatened or endangered species, the sustainability of
19 populations of important species of fish, shellfish or wildlife, or to the maintenance of
20 community structure in the vicinity of DCP. In this case, the EPA rules are clear that a
21 monetization of non-use benefits is not necessary. A qualitative discussion is adequate.

22 The qualitative description of non-use values in the TER Report is brief -- perhaps
23 too brief. Furthermore, most of it is a recounting of the theory of non-use values. The

1 purpose of this section is to argue that the non-use benefits of I&E reduction are
2 negligible. I believe the authors could be more convincing. Most people know there are
3 significant wildlife on the Central Coast south of Big Sur that *could* have significant
4 value to the general public – pelicans, seals and otters to mention a few. I would urge the
5 authors to more fully dispose of the notion that “important species of wildlife” will be
6 substantially affected by I&E reductions.