California MLPA Master Plan Science Advisory Team

Methods Used to Evaluate MPA Proposals in the North Coast Study Region (DRAFT) Appendix C. Impact Assessment Methods

Revised January 19, 2010

In order to estimate the potential socioeconomic impact to the commercial fishery sector associated with MPA proposals, staff from Ecotrust, contractor to the MLPA Initiative, will estimate the maximum potential impact for each of the MPA proposals using methods developed in the MLPA Central Coast Project (Wilen and Abbott 2006) and refined in the north central coast and south coast projects (Scholz et al. 2008; 2010). The analysis assumes that each of the MPA proposals completely eliminates fishing opportunities in areas closed to specific fisheries and that fishermen are unable to adjust or mitigate in any way (Wilen and Abbott 2006). The results can be considered as trade-offs for protections relative to socioeconomic impacts and can be weighed in siting and evaluating the various MPA proposals. The remainder of this paper describes the steps needed to complete the maximum potential impact analysis in the MLPA North Coast Study Region.

1: Generate Baseline Estimates of Gross Economic Revenue

The first step involves calculating a baseline estimate 1) from which to derive estimates of the socioeconomic impact associated with changes in commercial fisheries that might be induced by each MPA alternative and 2) against which to compare those estimates. The baseline estimate is generated using gross fishing revenues from California Department of Fish and Game landing receipts reported for ports in the MLPA North Coast Study Region. A nine-year average (2000–08) derived from the regional landing receipts and converted into current dollar values (i.e., $2008) is used.

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More specifically, to generate baseline estimates of gross economic revenue (GER), for any fishery, *f*, $BGER_f$ is the average ex-vessel value of the fishery in 2008 dollars, where $BGER_f = \sum_{p \in P} BGER(f, p)$, the sum of the baseline estimates of GER for this fishery over all ports.

Staff also define the fisheries specific to each port, or in other words, create a baseline estimate of gross economic revenue for each port. For a specific port, *p*, being considered in the MLPA North Coast Study Region, the baseline estimate ($BGER_p$) can be calculated as the sum of the baseline estimates of GER for this port over all fisheries:

$$BGER_p = \sum_{f \in F} BGER(f, p).$$

The baseline gross economic revenue ($BGER_{TOT}$) for <u>all</u> commercial fisheries ($f \in F$) being considered in the MLPA North Coast Study Region is therefore:

$BGER_{TOT} = \sum_{f \in F} BGER_f = \sum_{f \in F} \sum_{p \in P} BGER(f, p)$ or equivalently,

$BGER_{TOT} = \sum_{p \in P} BGER_p = \sum_{p \in P} \sum_{f \in F} BGER(f, p)$.

2: Generate Gross Economic Revenue for the Various MPA Alternatives

The next step involves using results from the Ecotrust mapping exercise, specifically stated importance indices for the fishing grounds, to estimate the socioeconomic impact associated with changes in the commercial fisheries that might be induced by each MPA alternative. For a description of the methods used to create stated importance indices, please see Scholz et al. (2006).

For any fishery, *f*, port, *p*, and any MPA alternative, *a*:

$$GER(f, p, a) = BGER(f, p) - GEI(f, p, a)$$

where $GEI(f, p, a)$ is the estimated gross economic impact on fishery, *f*, at any port, *p*, under any alternative, *a*.

Therefore,

$GER_f(a) = \sum_{p \in P} GER(f, p, a)$ and $GER_p(a) = \sum_{f \in F} GER(f, p, a)$

as well as

$GEI_f(a) = \sum_{p \in P} GEI(f, p, a)$ and $GEI_p(a) = \sum_{f \in F} GEI(f, p, a)$.

Gross economic revenue under any alternative, *a*, ($GER_{TOT}(a)$), for <u>all</u> commercial fisheries ($f \in F$) being considered in the North Coast Study Region can be calculated as:

$$GER_{TOT}(a) = \sum_{f \in F} GER_f(a) = \sum_{p \in P} GER_p(a) = \sum_{f \in F} \sum_{p \in P} GER(f, p, a) = \sum_{p \in P} \sum_{f \in F} GER(f, p, a)$$

From this it can be said that, for any MPA alternative, *a*,

$$GEI_{TOT}(a) = BGER_{TOT} - GER_{TOT}(a)$$

where GEI_{TOT_a} is defined as the total gross economic impact on all commercial fisheries under any alternative, *a*. Therefore,

$$GEI_{TOT}(a) = \sum_{f \in F} GEI_f(a) = \sum_{p \in P} GEI_p(a) = \sum_{f \in F} \sum_{p \in P} GEI(f, p, a) = \sum_{p \in P} \sum_{f \in F} GEI(f, p, a).$$

3: Generate Baseline Estimates of Net Economic Revenue

In order to compute net economic benefits, staff 1) estimate the share of gross fishing revenues represented by costs and 2) scale the baseline estimate (i.e. gross fishing revenues) calculated in Step 1 using the estimated cost shares. In the central coast process, an estimate of 65% was used across all fisheries (Wilen and Abbott 2006). For the north coast process, several cost related questions are asked during interviews with fishermen in an effort to improve on this estimate as well as allow for the ability to account for cost variability among different fisheries. After all interviews are completed, the cost data are broken out by fishery or fisheries. For example, cost data for a fisherman who fished both salmon and crab would be aggregated with only other interviewees participating in both those fisheries. A mean cost estimate will then be calculated for each category.

Costs will be broken into two categories: fixed costs and variable costs. Fixed costs include costs that are independent of the number of trips a vessel makes or the duration of these trips. For example, vessel repairs and maintenance, insurance, and mooring and dockage fees are typically considered fixed costs. On the other hand, variable costs include costs that are dependent on the number of trips a vessel makes or the duration of these trips. Variable costs typically include fuel, maintenance, crew share, and gear repair/replacement. For the purpose of this study, crew wages and fuel costs will be considered variable costs. All other costs will be considered fixed costs.

For any fishery, *f*, net economic revenue is calculated as:

$$BNER_f = BGER_f - C_{X_f} - C_{V_f}$$

where C_{X_f} is the fixed cost associated with any fishery, *f*, and is set as a fixed dollar value, and C_{V_f} is the variable cost associated with any fishery , *f*, and is a fixed percentage of $BGER_f$.

Baseline net economic revenue ($BNER$) for <u>all</u> commercial fisheries ($f \in F$) being considered in the MLPA North Coast Study Region can be calculated as:

$$BNER_{TOT} = \sum_{f \in F} BNER_f$$

4: Generate Estimates of Net Economic Revenue for the Various MPA Alternatives

In order to compute net economic revenue for each of the various MPA alternatives, staff (1) estimate the share of gross fishing revenues represented by costs under each MPA alternative, and (2) scale the estimated gross fishing revenues for that alternative accordingly. Costs are calculated using the methods described in Step 3.

For any fishery, *f*, and any MPA proposal, *a*,

$$NER_f(a) = GER_f(a) - C_{X_f} - C_{V_f} \quad .$$

For any MPA alternative, *a*, net economic revenue for <u>all</u> commercial fisheries ($NER_{TOT}(a)$) can be calculated as:

$$NER_{TOT}(a) = \sum_{f \in F} NER_f(a)$$

5: Generate Estimate of the Potential Primary Net Economic Impact for the Various MPA Alternatives

Using the results from the previous steps, the potential primary net economic impact (NEI) of a particular MPA alternative, *a,* on a particular fishery, *f,* can then be calculated as:

$$NEI_f(a) = BNER_f - NER_f(a).$$

The potential primary NEI of any MPA alternative, *a,* on <u>all</u> commercial fisheries ($f \in F$) can then be calculated as:

$$NEI_{TOT}(a) = BNER_{TOT} - NER_{TOT}(a).$$

6: Generate Estimate of the Potential Primary Gross Economic Impact for the Various MPA Alternatives

Using the results from steps 1–5, the potential primary gross economic impact (GEI) of a particular MPA alternative, *a,* on a particular fishery, *f,* can then be calculated as:

$$GEI_f(a) = BGER_f - GER_f(a).$$

The potential primary GEI of any MPA alternative, *a,* on <u>all</u> commercial fisheries ($f \in F$) can then be calculated as:

$$GEI_{TOT}(a) = BGER_{TOT} - GER_{TOT}(a).$$

Example of Estimate Costs

For fishery *f*, assume the following proportion of gross economic revenue goes to the following costs:

20% = fixed costs

20% = crew wages

10% = fuel costs → 30% = variable costs

Assume that baseline gross economic revenue equals $10,000. Under the baseline, fixed costs equal $2,000 and variable costs equal $3,000, resulting in total costs of $5,000. Assume that under MPA alternative *a,* gross economic revenue now equals $5,000. Under this alternative, fixed costs will still equal $2,000; however, variable costs will be recalculated as:

$5,000 * 0.3 = $1,500

This results in total costs of $3,500 under MPA alternative *a.*

References for Appendix C

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Wilen, J. and J. Abbott. 2006. Estimates of the Maximum Potential Economic Impacts of Marine Protected Area Networks in the Central California Coast. Final report submitted to the California MLPA Initiative in partial fulfillment of Contract #2006-0014M (July 17).