# Sea Grant Economics 101

## A Program Guide for Reporting and Communication

## Table of Contents

## Background and Purpose

**Background:** Economics is a vast social science composed of many sub-disciplines and theoretical frameworks, and Sea Grant programs must use economic concepts and methods to estimate the value of their activities. Sea Grant programs report these economic impacts and benefits, as required by the Government Performance and Results Act (GPRA), using the Planning, Implementation, and Evaluation Resources (**PIER**) database. They also estimate economic impacts and benefits and impacts for broader communication purposes that they do not report in PIER.

**Purpose:** This guide is not intended to replace an economics degree and help you implement your own **valuation** methods. It is also not meant to be a guidance document for what will and will not be accepted by the National Sea Grant Office for economic performance measure reporting. Instead, it focuses on a small segment of economic concepts and methods that are most pertinent to helping Sea Grant programs defensibly estimate values and clearly communicate program activities. In particular, this guide will facilitate your use of the suite of valuation resources available on the National Sea Grant Office's (NSGO's) Inside Sea Grant webpage by improving your understanding of:

- Some basic economic concepts as they relate to estimating values for the Sea Grant economic performance measure and impact or accomplishment reporting to PIER, as well as for broader, non-PIER-related communication purposes (Section 1).
- How to best use **value chains** to integrate economic values or impacts into your valuation (Section 2).
- When and how to use surveys in estimating values (Section 3).
- Additionally, we have provided definitions for bold terms in this document in Section 5.

### SEA GRANT VALUATION OBJECTIVES

The suite of valuation resources employs economic concepts and principles from various sub-disciplines and frameworks to develop valuation resources that meet these three objectives:

| Reliable | Consistent | Accessible |
|---|---|---|
| Economic benefits and impacts that are monetized or described by programs are defensible and can be explained. | The methodologies or policies being used by one program to monetize or describe an economic impact or benefit are the same as those being used by another program that is also capturing that same benefit or impact. | The methodologies can be understood and primarily be implemented by non-economists or with minimal support from economists. |

# Section 1: Sea Grant Economics Key Concepts and Definitions

## *Do My Program Activities Generate Economic Impacts or Economic Benefits?*

The terms **economic impact** and **economic benefit** are often, and incorrectly, used interchangeably. Here are some definitions[1] from economic literature to help you understand what we mean when we use this language in the methodology guides and to help you use the language with more accuracy and clarity:

- Economic impact: Net changes in economic activity (e.g., jobs, salaries, gross domestic product [GDP]) in a region. An economic impact either creates or keeps revenue in a given economy that would not exist or that would leave the region otherwise (e.g., creating jobs, saving an entity money, helping to drive up revenue in a region).
- Economic benefit: Net increase in social welfare through market or non-market forces (e.g., enhanced recreation, value of increased knowledge or skills, value associated with improved water quality, reduced damages from storms).

Impacts and Benefits could be categorized into private or social benefits or impacts. While programs are not required to make this distinction, it will increase the effectiveness of your value chain when you clearly define who is benefiting from your program activities.

## *What Are Outputs and Outcomes and Which Should I Use for Valuation?*

The terms **output** and **outcome** are often, and incorrectly, used interchangeably when discussing the results of program projects and activities. Below are some definitions to help you understand the difference between outputs and outcomes.

- Outputs are quantifiable short-term metrics that describe Sea Grant programs' projects or activities.
  - Examples of outputs include number of workshops, number of attendees at capacity building events or trainings, resource/product clicks or downloads from a program's website, user time (hours) spent with a resource or product, distance traveled (miles) to attend a workshop or training, etc. Sea Grant has methods in the valuation methodology guides to estimate what is often a conservative **lower bound** value or minimum willingness-to-pay to participate and obtain information, knowledge, or skills. Outputs do not include the results or the economic impacts or benefits of using the newly obtained information, knowledge, or skills to generate other economic impacts or benefits.
- Outcomes are the results of Sea Grant activities that can lead to economic impacts or benefits. These can include shorter-term impacts such as increased information, knowledge, or skills gained, although many of the valuation approaches in the Sea Grant suite of resources focus on the medium- and longer-term outcomes that result from behavior changes or increased knowledge.

1 These definitions of economic impact and economic benefit are consistent with definitions used in previous NOAA publications—e.g., Watson, P., Wilson, J., Thilmany, D., & Winter, S. (2007). Determining Economic Contributions and Impacts: What is the difference and why do we care? *Journal of Regional Analysis and Policy*, 37 (2), 140–146. Generally, net changes (increases and decreases) refer to the sum of all benefits minus the sum of all costs. In this guide and NSGO's suite of valuation resources, we do not incorporate costs. That is, programs are not required to estimate costs, nor are they required to subtract costs from their benefit estimates.

- For example, if a training attendee used the knowledge they obtained (a short-term outcome) during the training to grow business revenue and create new jobs, the increased revenue and new jobs would be outcomes (economic impacts) generated by the training.

**So which should you value?** Simply put, value outcomes when feasible and reasonable based on the level of effort and expertise required. Outcomes are representative of the actual economic impact or benefit and provide the most accurate metric and most compelling story regarding how the Sea Grant activity generated value. However, outcomes can take years to be realized and can be hard to track, so estimating the value of outputs may be the only feasible approach. Outputs only provide a **proxy** for the value generated, often vastly underestimating the value, but they are typically much easier to value. The Workshops and Training and Capacity Building guides both present approaches for valuing outputs when necessary. However, for large, resource-intensive projects or program activities that reflect state, local, and/or program priorities, it might be worthwhile to invest in an outcome valuation.

## Valuing Outcomes with Multiple Degrees of Separation

**Degrees of separation** is a non-technical term to describe how one Sea Grant activity outcome leads to another. Degrees of separation are determined by measuring the number of steps between the Sea Grant activity and the outcome in question. Figure 1 provides a visual representation of degrees of separation.


*Figure 1. Visual representation of degrees of separation.*

Sea Grant program activities often generate outcomes with multiple degrees of separation—that is, they generate economic impacts and/or benefits that yield subsequent outcomes with economic impacts and/or benefits. Programs then find themselves wondering, "Can I claim these subsequent economic impacts and/or benefits?" For example, Sea Grant might develop a mapping tool to help communities better understand their vulnerability to sea level rise. A community's enhanced understanding of its vulnerability is one degree of separation from Sea Grant's efforts. However, it would be considered two degrees of separation if the community used its enhanced understanding of vulnerability to implement a green infrastructure project to reduce the impacts of sea level rise.

No set number of degrees of separation necessarily determines what is **defensible** to value, and degrees of separation are not always easy to distinguish. However, each additional degree of separation makes it increasingly difficult to convincingly connect a Sea Grant activity to the resulting economic impact or benefit realized, so it is a useful concept to understand. Below are two examples in which valuing economic impacts and/or benefits with multiple degrees of separation might be a worthwhile investment (e.g., investing in data collection, consulting an economist)—depending on community, program, and state priorities. Example A illustrates three degrees of separation:

> **Example A:** A Sea Grant program created a tool to help coastal communities better understand exposure to sea level rise and flooding from storm surge. The purpose of Sea Grant's tool was to build the decision-making capacity of communities and to inform possible action to protect communities (**one degree of separation from Sea Grant's efforts**). One community used Sea Grant's tool and determined that it needs to construct a 1,000-

foot sea wall in order to protect 50 homes in a neighborhood highly vulnerable to flooding (**two degrees of separation from Sea Grant's efforts**). This sea wall will save millions of dollars in potential damages. After observing the success of the community's sea wall implementation, a neighboring town decided to construct its own sea wall **without using the tool** to yield similar benefits (**three degrees of separation from Sea Grant's efforts**).

Sea Grant might consider investing resources (e.g., collecting data, consulting an economist, attending trainings) in valuing the benefit of the 50 protected homes and then use that value to tell a compelling story that connects the benefit estimate to Sea Grant's sea level rise and storm surge flooding tool. In the case of the neighboring town that constructed its own sea wall without the tool, Sea Grant cannot claim an essential role and would not value that outcome.

**Example B:** Sea Grant funded research to better monitor natural waters for the presence of harmful algal blooms (HABs). The purpose of the research was to enhance water monitoring to improve water quality, increase recreation, and improve human health and safety (**one degree of separation from Sea Grant's efforts**). Additionally, Sea Grant's research was included in the development of a detection technology, which could yield millions of dollars in economic impacts and benefits (**two degrees of separation from Sea Grant's efforts**).

Sea Grant might consider investing resources (e.g., collecting data, consulting an economist, attending trainings) in refining the estimate of the detection technology's economic impacts and benefits and then tell a compelling story that connects the benefit estimate to Sea Grant's funded research.

When determining whether it is defensible to value economic impacts and/or benefits that are two or more degrees of separation from Sea Grant's project/activity, consider the following:

- Does the Sea Grant activity or resource reflect program, local, and/or state priorities?
- Does your program have the resources (time, money, expertise) to invest in estimating values?
- Can you report the value in PIER as part of the economic performance measure or as an impact or accomplishment statement, or will you use the value as part of a compelling story for other communications purposes?
- Can you clearly and defensibly link Sea Grant's activity to the benefit or impact?
- Are data available to establish a **baseline** and measure changes from that baseline (see the "Establishing Baseline Data" section of this guide)?

### *Can I Claim All, Some, or None of the Benefit/Impact?*

**Attribution** is a challenging concept that involves determining whether programs can claim all, some, or none of an economic impact and/or benefit. Some examples and guidance for when programs can claim all or some of an economic impact/benefit are listed below.

**Consider claiming all of the economic impact or benefit when the outcome would not have occurred without your Sea Grant program.**

Generally, programs can claim all of an economic impact/benefit when Sea Grant causes **measurable change** (see the "Value Chain" section of this guide) that would not have occurred without Sea Grant (even if multiple stakeholders or Sea Grant programs were part of the project). Sea Grant programs must be able to clearly link their program to the measurable change and to say that none of this change would have happened without Sea Grant. Note: For the purpose of reporting and double counting, if there are projects where multiple Sea Grant programs contributed, the programs should allocate a portion of the total value of the economic impact/benefit in PIER to avoid exceeding the total value (this could be done based on level of effort from each program).

**Example C:** Sea Grant co-funded and co-hosted a remote oyster setting training (with another non-NOAA entity), which enabled an aquaculture business to increase its revenue by $100,000 in the year after the training and to hire four new staff members. Sea Grant can value and claim these economic impacts in PIER but should clarify that it was not the only stakeholder involved in the qualitative description. Although Sea Grant did not do all the work, the training outcome would not have occurred and yielded economic impacts/benefits without Sea Grant's contribution.

**Consider claiming some of the economic impact or benefit when part of the outcome would still have happened without Sea Grant.**

Generally, programs can claim some of an economic impact/benefit when Sea Grant partially contributes to a measurable change (see the "Value Chain" section of this guide) that can be translated into an economic impact/benefit. That is, programs can claim some of the economic impact/benefit if the outcome would still occur without Sea Grant's contribution, but the economic impacts/benefits would be incrementally reduced. Furthermore, to claim some or part of an economic impact/benefit, the program must know or be able to reasonably estimate Sea Grant's contribution.

> **Example D:** Sea Grant contributed $10,000 to a HAB public outreach campaign to inform beachgoers and recreational fishers of the potential hazards of HABs. The total public outreach campaign budget was $50,000 (Sea Grant contributed 20 percent of the budget [$10,000/$50,000]) and yielded $120,000 of economic benefits. The $120,000 economic benefit was generated by the community's enhanced public awareness, which led to the creation of a HAB monitoring program that reduced the number of people swimming in red tides and eating contaminated seafood. Thus, Sea Grant can claim responsibility for $24,000 (or 20 percent of $120,000) of the economic benefit. If Sea Grant did not contribute to the public outreach campaign, the budget would have been smaller, but the campaign would have likely still occurred and generated economic benefits.

## *What Are Multipliers and When Should I Use Them?*

Multipliers are numbers that represent proportional relationships among entities, industries, or regions. Input-output tools and software—such as IMPLAN, REMI, and BEA RIMS II—use multipliers to help us understand the ripple effect of cost savings, revenues, or jobs by estimating the direct, indirect, and induced economic effects of program activities (e.g., if you create more fishing jobs, more boats will be purchased, and the fishermen will spend their income throughout the economy).

**Multipliers cannot be used for performance measure reporting in PIER**; however, programs might sometimes invest in hiring an economist to use multipliers to communicate economic impacts and benefits for broader communications efforts. Below, we define direct, indirect, and induced effects (the ripple effect is the indirect effect plus the induced effect), which are estimated using multipliers.

- **Direct effects:** The immediate effects of an expenditure. For example, the direct effect of spending $200 on groceries is that the local grocery store has $200.
- **Indirect effects:** The secondary effects of an expenditure, wherein businesses spend more money on inputs to serve their customers. For example, the indirect effect of spending $200 on groceries is that the grocer spends money (e.g., $50) on produce from local farmers who supply the grocery store.
- **Induced effects:** The tertiary effects of an expenditure, wherein employees spend more money in the local economy. For example, the indirect effect of spending $200 on groceries is that the grocer's employees receive some portion of that money (e.g., $40), which they then spend in the local economy.

### Can I Use Multipliers to Report to Sea Grant's Performance Measure?

Sea Grant's work often results in cost savings, increased revenues, or job creation. The Office of Management and Budget (OMB) does not permit programs to report estimates calculated using multipliers.

### Can I Use Multipliers to Estimate and Communicate Economic Impacts?

Multipliers can be used to estimate and communicate direct, indirect, and induced effects outside of the economic performance measure. Programs might use multipliers for communication pieces, such as in grants or other research. These statements communicate programs' overall effects on their local, regional, or state economies. For transparency, include the software, program, or source of the multipliers used to derive the estimated values.

## Section 2: Valuation Components and Considerations

This section is intended to provide examples and key **valuation** lessons, tips, and guiding principles. It is not a walk-through of how to estimate values; such instruction can be found in the valuation methodology guides available on the Inside Sea Grant webpage. Note: It is important to determine at the onset of a project what data you might need before estimating values, and how you will obtain the data.

We use the following four examples (E, F, G, and H) throughout this section and subsections to impart valuation lessons, tips, and guiding principles:

**Example E:** A Sea Grant extension specialist runs the Master Naturalist Program, which helped conserve mixed forest because a participant was inspired to conduct conservation activities after attending the naturalist program. This program helped conserve 20 acres of mixed forest, which provides annual ecosystem service benefits in enhanced hunting and other recreation.

**Example F:** Collaborative efforts from Sea Grant and many partners have resulted in 393 active oyster aquaculture leases for a total of more than 6,000 acres leased since 2011. These collaborative efforts have increased the skills of commercial watermen and the annual harvest of oysters produced by aquaculture. In 2016, aquaculture farmers harvested 63,240 bushels, up from 48,400 bushels in the baseline year of 2015 (14,840 additional bushels before Sea Grant assistance).

**Example G:** A Sea Grant business retention and expansion program focused primarily on jobs in the agricultural community. By providing 150 participants with a new set of skills or enhancing their existing skills, 85 participants secured new employment, 45 expanded their existing businesses, and 20 began new businesses. The expansion and new businesses resulting from the program's participants supported 1,034 jobs in the field.

**Example H:** Sea Grant co-organized and hosted a field-based professional development training for teachers on watershed and estuary topics. The 14 teachers who attended the training spent 16 hours each learning about climate change and estuary science in accordance with Next Generation Science and Common Core standards. As a result of this training, the 14 teachers will be better able to engage with and teach their students about climate change and estuary science.

### *Value Chains*

Value chains are socioeconomic valuation tools that illustrate and sequentially tell the story of how value is created. By breaking the story of a Sea Grant project or activity into key components, value chains allow programs to clearly link their work to monetizable impacts and/or benefits.


*Figure 2. Components of a value chain.*

As shown in Figure 2, the five value chain components include the following:

- **Program, product, or service:** Who or what generates a benefit and/or impact. For example, is this your Sea Grant program, an extension specialist, or a Sea Grant product? Be as specific as possible when thinking about the program, product, or service to which you are referring.
- **What was affected:** What, or in some cases who, is affected as a result of the program, product, or service. For example, is a specific habitat, business, group of people, etc., affected by the program, product, or service?
- **What was done to get impact:** The action implemented by the program, product, or service to yield an effect or change to something (e.g., habitat, business) or some group of people (e.g., coastal residents).
- **Measurable change:** The effect or change, compared to the baseline, that the program, product, or service has generated for something (e.g., habitat, business) or for some group of people (e.g., coastal residents).
- **Societal economic benefit or impact:** The monetized (dollar) value of the measurable change that a program, product, or service has generated. The Sea Grant suite of valuation resources provides methods to estimate the monetized value of many Sea Grant programs, products, and services.

Using examples E through H, we illustrate how you can use value chains to clearly and defensibly describe how Sea Grant programs, products, or services generate economic impacts and/or benefits.

**Example E:** A Sea Grant extension specialist runs the Master Naturalist Program *[the program/product/service]*, which helped conserve mixed forest *[what was affected]* because a participant was inspired to conduct conservation activities after attending the naturalist program *[what was done to get impact]*. This program helped conserve 20 acres of mixed forest *[measurable change]*.

**Example F:** Collaborative efforts from Sea Grant and many partners *[the program/product/service]* have resulted in 393 active oyster aquaculture leases *[what was affected]* for a total of more than 6,000 acres leased since 2011. These collaborative efforts have increased the skills of commercial watermen *[what was done to get impact]* and the annual harvest of oysters produced by aquaculture. In 2016, aquaculture farmers harvested 63,240 bushels, up from 48,400 bushels in the baseline year of 2015 (14,840 additional bushels before Sea Grant assistance) *[measurable change]*.

**Example G:** A Sea Grant business retention and expansion program *[the program/product/service]* focused primarily on jobs in the agricultural community. By providing 150 participants *[what was affected]* with a new set of skills or enhancing their existing skills *[what was done to get impact]*, 85 participants secured new employment, 45 expanded their existing businesses, and 20 began new businesses. The expansion and new businesses resulting from the program's participants supported 1,034 jobs in the field *[measurable change]*.

**Example H:** Sea Grant *[the program/product/service]* co-organized and hosted a field-based professional development training *[what was done to get impact]* for teachers *[what was affected]* on watershed and estuary topics. The 14 teachers who attended the training spent 16 hours each learning about climate change and estuary science in accordance with Next Generation Science and Common Core standards. As a result of this training, the 14 teachers will be better able to engage with and teach their students about climate change and estuary science *[measurable change]*.

## *Establish a Baseline*

A baseline is a starting point that can be used to identify and measure change by comparison.

Before determining the measurable change and translating it into an economic impact/benefit, you must establish a baseline, or consider normal conditions, so the change(s) that your program activities yield can be isolated. Below, we outline two potential ways for you to think about baselines as you consider how to best establish one for your project or program activity.

1. Historical/observed baseline: What occurred before Sea Grant was involved? You can establish the historical/observed baseline using either of the following data types:

    a. Data from previous year. For example, Sea Grant research developed techniques to improve oyster health in aquaculture operations, which increased revenue for one aquaculture operation in fiscal year 2020. The baseline in this example would be the aquaculture operation's revenue in fiscal year 2019.

    b. Trend data. You can use historical trend data to establish a baseline in the current year if you can defensibly assume the trend will continue. For example, the trend of the aquaculture operation's total number of employees from 2015 to 2019 can be used to establish a baseline for 2020 employment if you can defensibly assume that the trend would continue without Sea Grant's intervention. Using the employment data trend for 2015–2019 and assuming the trend will continue, we can estimate that the 2020 baseline employment figure would be 100 employees, as follows:

        i. 2015: 600 employees

        ii. 2016: 500 employees

        iii. 2017: 400 employees

        iv. 2018: 300: employees

        v. 2019: 200 employees

        vi. 2020 [baseline]: 100 employees (baseline year estimated based on 2015–2019 trend)

Determining a baseline using historical or observed data requires a relatively low level of effort. It is important that you take the time to ensure that the data and/or observations you use to determine your baseline are geographically and contextually appropriate. For example, it would not be appropriate to use ecosystem service value data from a Louisiana marsh restoration project as a baseline for your program's coastal marsh restoration efforts in Maine. As a general rule of thumb, use data that are as geographically and contextually precise as possible when determining your baseline.

2. Future/forward-looking baseline: In the absence of Sea Grant, what could or would have happened? The need to predict a baseline further into the future is particularly common when assessing longer-term outlooks associated with climate change—for example, the modeled damages that could or would have occurred to homes without Sea Grant's green infrastructure project that protects a coastal neighborhood. The baseline in this example would be the potential value of damages without Sea Grant's intervention. Determining a baseline by modeling future or forward-looking data is likely to require a relatively high level of effort and additional expertise.

Modeling potential effects or changes using tools like COAST is a forward-looking approach that can be relatively resource-intensive. You might consider investing in this approach for large projects or efforts that reflect local, state, or program priorities.

## *Measurable Change*

The measurable change is the effect or change, compared to the baseline, that the program, product, or service has generated for something (e.g., habitat, business) or for some group of people (e.g., coastal residents). The measurable change is the result of the Sea Grant activities or projects minus the baseline.

Using the above definition, we can determine that the measurable changes from examples E through H are as follows:

**Example E:** 20 acres of mixed forest conserved

**Example F:** 14,840 bushels of oysters harvested

**Example G:** 85 newly supported jobs, 45 supported businesses, 20 created businesses, and 1,034 additional jobs supported

**Example H:** 14 teachers trained

## *Translating Measurable Changes to Economic Impacts or Benefits*

Below, we again present value chain writeups for examples E through H and point to the valuation methodology guides that you can use to translate the measurable changes to economic impacts and/or benefits.

**Example E:** A Sea Grant extension specialist runs the Master Naturalist Program *[the program/product/service]*, which helped conserve mixed forest *[what was affected]* because a participant was inspired to conduct conservation activities after attending the naturalist program *[what was done to get impact]*. This program helped conserve 20 acres of mixed forest *[measurable change]*. To estimate the economic benefit illustrated above, use the methods provided in the Ecosystem Service Valuation guide.

**Example F:** Collaborative efforts from Sea Grant and many partners *[the program/product/service]* have resulted in 393 active oyster aquaculture leases *[what was affected]* for a total of more than 6,000 acres leased since 2011. These collaborative efforts have increased the skills of commercial watermen *[what was done to get impact]* and the annual harvest of oysters produced by aquaculture. In 2016, aquaculture farmers harvested 63,240 bushels, up from 48,400 bushels in the baseline year of 2015 (14,840 additional bushels before Sea Grant assistance) *[measurable change]*. To estimate the economic impact illustrated above, use the methods provided in the Aquaculture Revenue and Cost Savings guide.

**Example G:** A Sea Grant business retention and expansion program *[the program/product/service]* focused primarily on jobs in the agricultural community. By providing 150 participants *[what was affected]* with a new set of skills or enhancing their existing skills *[what was done to get impact]*, 85 participants secured new employment, 45 expanded their existing businesses, and 20 began new businesses. The expansion and new businesses resulting from the program's participants supported 1,034 jobs in the field *[measurable change]*. To estimate the economic impact illustrated above, use the methods provided in the Jobs and Business Support and Creation guide.

**Example H:** Sea Grant *[the program/product/service]* co-organized and hosted a field-based professional development training *[what was done to get impact]* for teachers *[what was affected]* on watershed and estuary topics. The 14 teachers who attended the training spent 16 hours each learning about climate change and estuary science in accordance with Next Generation Science and Common Core standards. As a result of this training, the 14 teachers will be better able to engage with and teach their students about climate change and estuary science *[measurable change]*. To estimate the economic benefit illustrated above, use the methods provided in the Workshops and Trainings guide.

## *NSGO Valuation Resources*

NOAA's NSGO has developed a suite of valuation resources to help programs better value and communicate the economic impacts and benefits that their activities generate. These resources are available on Inside Sea Grant's webpage.

### Preliminary Materials

The following materials are intended to help programs frame their thinking before using the economic valuation guides (Primer and this Sea Grant Economics 101 guide) and to help programs determine which guides to use for their activities (decision trees):

- Sea Grant Economics 101: A Program Guide for Reporting and Communication (this document)
- Methodology Guide Primer
- Methodology Guide Decision Tree
- Resilience/Hazard Decision Tree

### Valuation Methodology Guides

Programs can use the following valuation methodology guides to help value and communicate the economic impacts and/or benefits that they generate:

- Community Rating System
- Ecosystem Service Valuation
- General Revenue and Cost Savings

- Jobs and Businesses
- Workshops and Trainings
- Aquaculture Revenue and Cost Savings
- Workforce Development: Fellowships
- Business Continuity
- Capacity Building
- Damage Reduction from Coastal Flooding
- Increased Human Health and Safety

## Section 3: Conducting Surveys

Surveys that feature standard questions are a means to collect the primary data (i.e., data that you and your program collect) you need to defensibly monetize your Sea Grant activities. Surveys are sometimes the only way to collect baseline data or measure changes resulting from a Sea Grant activity. They do not necessarily need to be implemented via tools like Survey Monkey, Google Forms, or Qualtrics; rather, they can also be done via webinar polls, in-person discussions, or email/phone conversations. However, survey data collection tools are often helpful when compiling data from a larger number of respondents. The suite of valuation resources available via Inside Sea Grant's webpage reference shorter, easier-to-implement surveys, which are discussed in depth in some of the guides (e.g., the Capacity Building guide). Several of the guides discuss willingness-to-pay surveys and the need for an economist to design and implement one. This section is not intended to prepare you to run complex surveys without prior training; however, it should provide some context about the needs, obstacles, and power of simple surveys in valuation.

When possible, consulting a social scientist can greatly improve the quality and defensibility of your survey. Because this is not always possible, consider the information presented in this section and the methodology guides before implementing a survey.

### *When Should I Use a Survey?*

A few key questions will help you determine whether you might want to consider a survey.

**Do you have existing data that can support a defensible valuation approach?** In addition to primary data (data that you and your program collect) collected through a survey, programs can often use secondary data (existing data collected by someone other than the primary user) by researching federal, state, or local databases (e.g., Bureau of Labor Statistics or municipal tax assessor data). Secondary data include, for example, wage rates by occupation or property value. Additionally, Sea Grant programs can use secondary data by modeling or forecasting possible damages, disruptions, or hazards.

**Is the level of effort needed to implement the survey justified by the likely results?** This is an important question to answer for any valuation work. If you expect that the result will be small in value and the level of effort to estimate that result will be quite large, it may be best to develop an impact statement rather than expend effort to estimate values. However, if the result may be large or the survey data may be valuable for your future valuation efforts or for other Sea Grant programs, you may find the effort is quite worthwhile. This will often be driven by how hard it will be to implement the survey on your end. Questions to help you determine the level of effort necessary include:

- How many respondents do you need to contact?
- Is it easy to reach out to your potential respondents?
- Do you need to go through an Institutional Review Board?

Opportunities to gather data include:

- Pre-event or pre-project surveys
- In-person discussions or observations
- Web-based polls or surveys
- Follow-up web surveys
- Email or phone surveys
- Email or phone conversations

- Is your survey complex, such that you should consult with a social scientist or economist?
- Does your university have other requirements or restrictions for implementing surveys?

**What stage of the project or activity are you in?** It is important to plan at the beginning of a project for whether or not you will need a survey. This will enable Sea Grant to access people and collect data in real time when attendees are already engaged rather than having to contact them after the fact.

## *What Types of Questions Should I Ask?*

Your data needs will drive the question development. In the methodology guides, we present questions that get at a respondent's willingness to pay[2] for a product or outcome as well as other simpler survey questions to support valuation. Below, we discuss some key components of these types of questions along with considerations when implementing surveys with them.

### Willingness-to-Pay Surveys

Willingness-to-pay surveys use iterative questions to measure the maximum dollar value that respondents are willing to pay for a product, service, or experience. Creating an effective willingness-to-pay survey is complex and requires an economist—and possibly a team of social scientists—to correctly and defensibly design the survey questions to yield meaningful results. The results of a willingness-to-pay survey can be used in conjunction with the total number of users or attendees, as well as other contextual information, to estimate the value of a Sea Grant activity or project. Below are examples of the types of questions an economist could draw from to design a willingness-to-pay survey.

**To determine how sea level rise data are used, an economist might ask:**

- How did you access data/information?
- For what purpose did you access data/information (e.g., for work or personal reasons)?
- What industry do you work in?
- How often did you access data/information (both as an employee and as a private individual)?
- What percent of each type of data/information did you access/use (both as an employee and as a private individual)?

**To estimate the value of the data, an economist might ask:**

- Would a $X annual subscription be acceptable for the data/information?
  - Both as an employee and as a private individual.
  - For several different costs (e.g., $2X, $4X, $0.5X).

### Other "Simpler" Surveys

While willingness-to-pay surveys require an economist, there are other surveys you can perform without an economist that support the valuation methodology guides. The questions in these types of surveys might include:

- How long did an attendee/user spend at a workshop or using a tool? (This helps establish the value of their time for attending a workshop or using a tool.)
- How much did someone spend on travel costs? (This helps establish the value someone puts on attending a workshop.)
- How much would someone have to spend (for the same information/benefit) in the absence of Sea Grant? (This helps establish cost savings.)

Guidance for implementing these survey questions is integrated in the methods section of relevant methodology guides. The key takeaway is that you can integrate simpler survey questions on your own to support valuation (but it never hurts to have a social scientist or economist review your questions).

2 A respondent's willingness to pay for a product is not the same as a willingness to pay survey, which you need to consult an economist or social scientist to implement.

## *What Should I Consider When Analyzing Survey Data?*

In determining how to analyze data, we present two examples. Examples I and J present the same information but use different numbers to illustrate some best practices when analyzing survey data.

**Example I:** Sea Grant conducts a web-based survey of those who download their sea level rise data. Sea Grant uses the survey data to estimate the value that users place on Sea Grant's data collection efforts. Over the course of one month, 1,000 users downloaded Sea Grant's sea level rise data, and only 10 individuals completed the survey following download. The average value provided by the 10 responses was $5,000.

**How to analyze these data?**
It would not be defensible to extrapolate the value of 10 survey responses and assume the value would be the same for the 990 non-responses. In this case, we recommend you qualitatively describe your **survey response rate** as additional context and present the estimate for the 10/1,000 survey respondents. Thus, 10 (responses) x $5,000 (average response value) = $50,000 (estimated value that survey respondents place on Sea Grant's sea level rise data).

**Example J:** Sea Grant conducts a web-based survey of those who download their sea level rise data. Sea Grant uses the survey data to estimate the value that users place on Sea Grant's data collection efforts. Over the course of one month, 15 users downloaded Sea Grant's sea level rise data, and 10 individuals completed the survey following download. The average value provided by the 10 responses was $5,000. Sea Grant also understands from conversations with the non-respondents that they were able to productively use the information (even though they did not fill out the survey).

**How to analyze these data?**
In this case, because the vast majority of users who downloaded the data also responded to the survey, and Sea Grant knows the non-respondents also valued the data (from other communication with those users), it would be defensible to extrapolate the average value of the 10 responses to the 15 total individuals who downloaded the sea level rise data. Thus, 15 (individuals who downloaded data) x $5,000 (average value of 10 responses) = $75,000 (estimated value that survey respondents place on Sea Grant's sea level rise data). As we describe in the section below, it is important to be clear and transparent when communicating your results or reporting in PIER. Include your calculation steps and any assumptions you use to extrapolate data as part of your writeup.

## *Survey Response Rate, Confidence Interval, Confidence Level, and Margin of Error*

Below, we define terms that will be helpful in understanding your results, particularly if you are going to extrapolate your results more broadly. The definitions are oversimplifications to enhance your understanding of these concepts, which can range in complexity and are typically calculated using variance and standard deviation. Generally, it might be helpful to consult a social scientist or economist if you are estimating and analyzing these metrics.

We do not recommend specific targets for response rate, margin of error, confidence level, or confidence interval. You can use the data from your surveys regardless of these elements, as long as you caveat the economic impact/benefit estimates with these survey elements.

The survey response rate is a percentage that describes the number of surveys completed divided by the total **sample size**. (Note: There are other, more nuanced calculations for response rate.) It is often more defensible to extrapolate survey data with relatively high survey response rates (although this is also driven by the bias associated with non-respondents and how their answers would be different from respondents). The response rate also helps determine a **confidence interval** (see below).

The sample size is the part of a population or group of people who are selected or elect to take a survey.

The **margin of error** is an estimate of how far (usually in percentage points) an estimate might vary from the "true average" of a sample. Here is an oversimplified example to help you understand the concept: If you tell your boss that a research task might take you an hour, give or take 15 minutes, the margin of error is 15 minutes. In actuality, this will require a statistical calculation that depends on the number of responses, the value of those responses, and the desired **confidence level** (see below).

The confidence interval is the range of values that includes the true average plus or minus the margin of error. In our oversimplified margin-of-error example above, the confidence interval would be between 45 and 75 minutes, because one hour (60 minutes) minus 15 minutes (i.e., the margin of error from above) is 45 minutes, and one hour plus 15 minutes is 75 minutes.

The confidence level is the level or degree of certainty that a data point in the sample will fall within the confidence interval. Continuing with the oversimplified example above, if you tell your boss that a research task will take one hour, give or take 15 minutes, with a 95 percent level of confidence, this means that there is a 95 percent probability that the research task will be completed within the confidence interval (45 to 75 minutes) and a 5 percent chance (100 percent - 5 percentage points) that the task will be completed in less than 45 or more than 75 minutes.

In some instances, a practical approach to surveys is feasible; however, there is an entire discipline dedicated to survey design and implementation, as developing defensible survey results can be complex. Due to the wide-ranging topics that Sea Grant staff engage with communities about, the depth of survey design and level of expertise needed will vary greatly from program to program and project to project. Thus, it is important to think about why you want to conduct a survey and how you want to use the resulting data. Brainstorming about program goals for conducting a survey will help you determine whether you might need to consult a social scientist or economist. To learn more about how margin of error, confidence interval, and confidence level are calculated and related to a sample, see the sample size calculators below. In some instances, you might consider consulting a social scientist to discuss the value of obtaining a representative sample when conducting a survey.

- Sample size calculator. This calculator helps users simply determine the number of responses needed to achieve a desired margin of error and confidence level.
- Sample size calculator with a user-determined margin of error. This calculator allows users to input the sample size to calculate the confidence level or confidence interval.

### When Should I Consider Analyzing the Survey Response Rate, Confidence Interval, Confidence Level, and Margin of Error?

If you are only going to aggregate the results from completed surveys, these metrics are helpful context; however, you do not need to fully understand them to aggregate your survey results. If you are hoping to extrapolate your results from your respondents over a broader universe (of individuals who did not respond to your survey), it will be important to understand these concepts, and you should consider consulting a social scientist to assess the defensibility of extrapolating your results.

## Section 4: NSGO Guidance and Who to Contact

You can find NSGO's full suite of valuation resources on the Inside Sea Grant webpage. For more information or if you have specific questions about using this document or the methodology guides, please contact:

**Alison Krepp**
NOAA NSGO Social Science and Economics Lead
Email: Alison.Krepp@noaa.gov
https://seagrant.noaa.gov/About/National-Office

The suite of valuation resources are reference tools only and do not constitute formal performance measure or reporting guidance from the National Sea Grant Office. Please contact oar.sg.info-admin@noaa.gov with any reporting questions.

## Section 5: Terms of Reference

The definitions below have been developed to be consistent with performance measure guidance, NOAA documents, and account for the programmatic context of and practical application by Sea Grant programs. Outside of the programmatic context applied in these definitions and in this document, a more robust conversation on valuation and the terms used can be found in economics literature.

**Attribution:** Concept referring to whether programs can claim all, some, or none of an economic benefit and/or impact.

**Baseline:** A starting point that can be used to identify and measure change by comparison.

**Confidence interval:** The range of values that includes the true average plus or minus the margin of error.

**Confidence level:** The level or degree of certainty that a data point in the sample will fall within the confidence interval.

**Defensible:** Economic methods, concepts, frameworks, and estimated values that are grounded in and supported by economic theory and literature.

**Degrees of separation:** Non-technical term describing how one Sea Grant activity outcome leads to another; measures the number of steps between the Sea Grant activity and the outcome in question.

**Direct effects:** The immediate effects of an expenditure.

**Economic benefit:** Net increase in social welfare through market or non-market forces (e.g., enhanced recreation, value of increased knowledge or skills, value associated with improved water quality, reducing damage from storms).

**Economic impact:** Net changes in a region's economic activity (e.g., jobs, salaries, GDP); these impacts either create or keep revenue in a given economy that would not exist or that would leave the region otherwise (e.g., creating jobs, saving an entity money, helping to drive up revenue in a region).

**Indirect effects:** The secondary effects of the expenditure, wherein businesses spend more money on inputs to serve their customers.

**Induced effects:** The tertiary effects of an expenditure, wherein employees spend more money in the local economy.

**Lower bound:** The lowest defensible (or a conservative) value of a range that can be determined with a relative level of confidence.

**Margin of error:** The estimate of how far (usually in percentage points) an estimate might vary from the "true average" of a sample.

**Measurable change:** The effect or change, compared to the baseline, that the program, product, or service has generated for something (e.g., habitat, business) or for some group of people (e.g., coastal residents); i.e., the result of the Sea Grant activities or projects minus the baseline.

**Outcomes:** The results of Sea Grant activities that can lead to economic impacts or benefits; these can include shorter-term impacts such as increased information, knowledge, or skills gained, as well as medium- and longer-term outcomes resulting from behavior change or increased knowledge.

**Outputs:** Quantifiable short-term metrics that describe a Sea Grant program's projects or activities.

**PIER:** An online system designed to facilitate communication between NOAA and the partner Sea Grant Programs. Programs integrate strategic plans, projects and funding, and project results – e.g. performance measures, metrics, and program impact and accomplishments. It is a resource for sharing Planning, Implementation, and Evaluation (PIE) information on a program scale and can be rolled up to tell a national story.

**Proxy:** A value that can reasonably and defensibly be used to represent another value.

**Survey response rate:** The number of surveys completed divided by the total sample size, expressed as a percentage.

**Sample size:** The part of a population or group of people who are selected to take a survey.

**Upper bound:** The highest defensible value of a range of values that can be determined with a relative level of confidence.

**Valuation:** The use of defensible methods to estimate the dollar value of the economic impacts and/or benefits generated by Sea Grant program activities.

**Value chains:** Socioeconomic valuation tools that illustrate and sequentially tell the story of how value is created.