Appendix 3: Guidelines for Calculating the Fishing Contribution to GDP

General

As with the estimation of any contribution to GDP, the most appropriate method to use will depend on the nature of the data and the resources available to collect and analyse these data.

The compilers of national accounts must strike a balance in their desire for accuracy and the limitations on the time and effort they can dedicate to collecting and analysing data. In the case of fishing, striking this balance means that they are usually limited to using generalised estimates of income or production. In the consultant's opinion, the minimum level of aggregation that should be used would divide fishing into three categories: (i) locally based offshore fishing (foreign-based fishing in a country's zone does not contribute to that country's GDP), (ii) coastal commercial fishing, (iii) coastal subsistence fishing. In the Pacific Island countries that have significant freshwater fisheries (e.g. PNG, Fiji) or aquaculture (e.g. Cook Islands, New Caledonia) these categories should be added.

In general, where good and comprehensive data exists at the fishing enterprise level, the income approach to estimating fishing contribution is likely to be the most accurate, informative, and timely. Some of the recent DevFish studies are in this category (e.g. Philipson 2006; Philipson 2007; P. Philipson, per. com. November 2008). Unfortunately, such data at the enterprise level is usually not available; it either does not exist or is confidential. Applying the income approach to estimating GDP becomes especially difficult when dealing with the many small companies that are involved in coastal commercial fishing in most Pacific Island countries. The production approach may be the only viable option for calculating fishing contribution to GDP.

Although the production approach may be the most practical method to use in estimating the contribution fishing to GDP, the compilers of national

accounts should, in many cases, be aware of, and compensate for, some important weaknesses in that approach, as follows:

- The assumption of fixed value added ratios (section below). In practice, these ratios are subject to substantial variation, more so than in any other industrial sectors. Major causes of this are changes in catch rates and in prices.
- The difficulty of estimating prices. Typically, prices for fish vary widely by fish size, species, product form, season, and market so that average price estimates derived from price data, as opposed to revenue data, can be substantially inaccurate.
- The need for specialised knowledge of the fishing sector. While the compilers of national accounts using the income approach can deal with fishing companies in much the same way that they deal with any commercial enterprise, the production approach requires greater insight into the special attributes of the sector. This involves knowledge of items like identification/inclusion of all significant components of the fishing sector, the aggregation of the similar components of the fishing sector (discussed above), determining value added ratios (discussed below), and estimating prices.

The difficulties with the production approach can be at least partially compensated for in several ways. Periodic surveys can be undertaken to "ground truth" the assumptions on value added ratios and prices. Export data can be used to estimate the production of large-scale commercial fishing, but official export figures are often inaccurate. In many countries the most appropriate mechanism for dealing with the difficulties with the production approach is simply more frequent and effective liaison between compilers of national accounts and government fisheries officials.

Value Added Ratios

The production approach to estimating the fishing contribution to GDP requires two basic sets of data: (i) value of gross output of fishing, and (ii) intermediate costs.

It is usually convenient to express the intermediate costs as a proportion of the gross output. For example, in the case of small-scale fishing using motorised boats, the fuel, bait, provisions, and maintenance are all intermediate costs. If the total value of the catch is $1,000 and the sum of the intermediate

costs is $400, then the proportion of the gross output attributable to intermediate costs is 40%. Therefore, the value added by small-scale fishing using motorised boats is $1,000 * (1-0.40) = $600. In this example, the intermediate cost ratio is 0.40 and its reciprocal, 0.60, is the value added ratio (VAR). It should be noted that the intermediate costs refer to operating expenses. Expenditures on large capital items, such as engines, are capital expenditures and are thus not counted as intermediate costs.

In practice, each operator is likely to have a different value added ratio. However, in the preparation of national accounts, it is usually not possible to individually measure each operation. The normal practice is to estimate an average value added ratio for each type of activity for each country.

Calculating Value Added Ratios

Offshore Fishing: All the enterprises involved in this sector are of large-scale commercial operations. Of necessity, these enterprises keep records of their income and expenditure from which it is possible to calculate a value added ratio. If income and expenditure data are available for every enterprise in the sector, an income approach to calculating the value added ratio would normally be used. However, when this is not the case, analysts must resort to using a production approach based on overall production from large-scale fishing and price data. In these circumstances, a sample of the income expenditure of one or more typical enterprises can be used to calculate the value added ratio for the sector.

Coastal Commercial Fishing: This sector is usually more diverse than large-scale commercial operations. There is often a marked difference in the type of vessel used by each enterprise. Typically, the vessel used could be specially designed fishing boats with inboard motors, outboard skiffs, and canoes. The cost of operating each type of vessel differs and, hence, the value added ratio of the related activity also differs. Some enterprises may keep income and expenditure records, but many do not. Also, it is often difficult to split the sector catch between each class of activity. In the circumstances, the analyst usually must resort to using a generalised estimate of value added ratios based upon information about the composition of the fleet. Information from which to estimate the value added ratios for small-scale fishing may be available from (i) the records of development banks and other financial institutions, (ii) surveying the sector, (iii) published reports on the sector including studies into the benefit/cost of proposed development projects, and (iv) anecdotal information from discussions with people involved in the sector.

Subsistence Fishing: The subsistence sector is also quite diverse. Subsistence fishing can include gleaning, canoe fishing, gill netting, cast nets, fish drives, fish traps, torch fishing, and trolling from motorised skiffs. While the value added ratio for each activity is different, in general, it should be possible to categorise subsistence fishing into two sets of activities: (i) those that involve motorised boats, and (ii) those that do not. The non-motorised fishing activities have a very low level of intermediate cost and, therefore, a high value added ratio. It would be rare for the value added ratio of the non-motorised activities to be less than 90%. In contrast, the motorised subsistence fishing activities range from high-cost trolling to medium- and low-cost bottom-fishing. Estimating the value added ratio of the non-motorised activities is likely to prove most difficult but, given the high percentage of value added in these activities, slight errors in the value added ratio used for them is unlikely to result in a major difference in the estimated contribution to GDP. The value added from motorised subsistence fishing activities should be very similar to that of the small-scale commercial fishing. Given the difficulty in separating the gross output of each activity in the subsistence sector, a reasonable approach is to estimate an average value added ratio weighted by the proportion of the catch (by value) taken by non-motorised and by motorised fishing activities.

Aquaculture: Village-level aquaculture in the region, most commonly involving tilapia and seaweed, has characteristically low intermediate costs. Financial records are often not maintained and consequently estimating valued added can involve considerable speculation. On the other hand, the relatively large-scale aquaculture operations of the region, mostly pearls and shrimp, have much higher intermediate costs. Good financial records are kept, but commercial secrecy becomes an issue in accessing the data for determining value added.

Freshwater: There is no good data on over-all freshwater fishery production in any Pacific Island country and any estimate involves a considerable amount of "educated" guesswork. Most of the production is for subsistence purposes and should be valued accordingly. The catch is mostly taken with low-technology gear, associated with high value added ratios. In some Pacific Island countries there is a significant amount of non-subsistence freshwater fishing, such as commercial fishing in the rivers of PNG, and the capture of Macrobrachium shrimp for roadside sales in Fiji.

Value added Ratios from Previous Studies

The value added ratios used by the earlier study (Gillett and Lightfoot 2001) are given in Box A3-1.

Box A3-1: Value added Ratios used in Gillett and Lightfoot (2001)

The value added ratios used in the earlier study were generally:	VAR
Large-scale offshore fishing	40% to 55%
Small-scale commercial fishing	55% to 70%
Subsistence	
non-motorized	90%
motorized	65% to 75%
Aquarium fish	65%
Seaweed cultivation	90%
Pearl culture	80%

Source: Gillett and Lightfoot (2001)

Although the above VARs were the best available at the time, there is considerable room for improvement. The Gillett/Lightfoot report stated: "Additional information on the economics of small-scale fisheries would contribute to improving the measurement of the fisheries contribution to GDP". Accordingly, the present study devoted considerable attention to gathering information from which improved VAR could be derived, with an emphasis on small-scale fishing and aquaculture. The data in the various reports of different types and scales of fishing was scrutinised and value added ratios were calculated.

Table A3-1: Value added Ratios from Recent Studies of Small-Scale Fishing and Aquaculture

Category	Activity/Location	Source/Date	VAR
Non-vessel fishing	Fishing without use of vessel, Niue; Using rods from the reef top by walking	Kronen (2007); study carried May–June 2005.	0.92
	Fishing without use of vessel, Pohnpei, Federated States of Micronesia. Fishing activity included mainly (in descending order) spearing, line fishing, and netting.	Rhodes et al. (2007), study carried out January 2006 to January 2007	0.89
Non-motorised fishing	Non-motorised canoe fishing, Pohnpei, Federated States of Micronesia. Fishing activity included mainly (in descending order) spearing, line fishing, and netting.	Rhodes et al. (2007), study carried out January 2006 to January 2007	0.91
	Non-motorised canoe fishing, Niue; deep-bottom fishing and/or the use of fishing rods and handlines from non-motorised canoes	Kronen (2007); study carried out May–June 2005.	0.95 to 0.98
Fishing from small outboard powered skiffs	Tuna trolling from outboard-powered skiffs in Tarawa, Kiribati	R.Stone, Forum Fisheries Agency unpublished data, 2007	0.60
	Outboard-powered fishing with engines 6 hp to 40 hp, Pohnpei, Federated States of Micronesia. Fishing activity included mainly (in descending order) spearing, line fishing, and netting.	Rhodes et al. (2007); study carried out January 2006 to January 2007	0.74 to 0.79
	Small boat fishing in New Caledonia; outboard vessels 3.4 to 4.5 m in length	Dupont et al. (2004); data from 2002 to 2004	0.65
	Small boat fishing in New Caledonia; outboard vessels 5.5 to 5.5 m in length	Dupont et al. (2004); data from 2002 to 2004	0.80
	Motorised skiff fishing, Niue; Using motorised boat transport for deep-water and pelagic fishing	Kronen (2007); study carried out May–June 2005.	0.61 to 0.72
	"Artisanal fishing" in Fiji	Reddy (2004); data from June 2003 to January 2004	0.51

Table A3-1: continuation

Category	Activity/Location	Source/Date	VAR
Fishing from vessels larger than 7 meters	Small boat fishing in New Caledonia; inboard vessels 7 to 8 m in length	Dupont et al. (2004); data from 2002 to 2004	0.65
	Small boat fishing in New Caledonia; inboard vessels 8.4 to 11.96 m in length	Dupont et al. (2004); data from 2002 to 2004	0.60
	Alia longline fishing in Samoa; Apia based	Hamilton (2007); data from 2006	0.47
	Alia longline fishing in Samoa; rural Upolu based	Hamilton (2007); data from 2006	0.48
	Alia longline fishing in Samoa; Savaii based	Hamilton (2007); data from 2006	0.39
Aquaculture	Tilapia farming model developed for the Pacific Islands, 2 pond farm (20x30 m), mill mix feed	SPC (unpublished data)	0.74
	Large-scale pearl culture in Fiji	J.Hunter (Personal comm.., November 2008)	0.452 to 0.508
	Pearl culture in the Cook Islands, 30% technician paid locally	R.Newnham (personal comm., October 2008); Years 2005 and 2006	0.41 (2005) 0.21 (2006)
	Pearl culture model developed for medium-size pearl farm in Kiribati	SPC (unpublished data)	0.69
	Live rock culture in Fiji	Lal and Cerelala (2005); data from 2000-2004	0.40
	Seaweed culture in the Solomon Islands	Cospi (2007)	0.72
Other	Coral harvesting in Fiji	Lal and Cerelala (2005); data from 2000-2004	0.70

The ratios in Table A3-1 should be considered indicative, rather than precise. In many of the studies listed there is a lack of information on taxes, depreciation, and loan interest – which may have several percentage points of effect on the VARs.

Some work has been conducted recently on value added ratios for offshore tuna fishing in the region. In 2006 to 2007 the FFA/SPC DevFish project enjoyed access to financial information at the enterprise level in several Pacific Island countries. On the basis of examining records at several longline and purse seine fishing companies, it was concluded that a value added ratio of 0.20 should be used for the period 2005-2007 for locally based longlining and 0.496 for purse seining. (Philipson 2006; Philipson 2007; P. Philipson, per. com. November 2008). From Smith and Tamate (1999), likely the best source of information for the VAR for industrial pole-and-line tuna fishing, a VAR of 0.60 has been estimated.

Value Added Ratios Used in this Report

In view of the above studies and experience gained from Gillett and Lightfoot (2001), in this report the value added ratios in Table A3-2 below are generally used. Some judgment is, however, required in using the VARs. Depending on the national situation, the mix of fishing activities, and associated intermediate costs of those activities, the value added ratios used in herein vary somewhat from Table A3-2.

Table A3-2: Value Added Ratios Used in this Report

Category of Fishing/Aquaculture	Specific Type	VAR
Offshore tuna fishing	Locally based longlining	0.20
	Locally based purse seining	0.50
	Locally based pole-and-line	0.60
Coastal commercial and subsistence	Fishing without a boat	0.90
	Fishing in non-motorised canoe	0.92
	Fishing with small outboard boat	0.60 to 0.80
	Tuna trolling	0.60
	Alia longline fishing	0.47
Aquaculture	Pearl culture	0.45
	Tilapia culture	0.74
	Seaweed culture	0.72
	Coral culture	0.40
Other	Coral harvesting	0.70
	Aquarium fish collection	0.65