

Developments of Gonado Somatic Index (GSI) in three major snapper species caught in the Indonesian Deep Demersal Fisheries.

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1 Snapper Maturity Monitoring Protocol

The goal of this snapper maturity monitoring protocol is to generate a data set for the verification of existing estimates of size at 50% maturity for major target species in the Indonesian snapper fisheries. Existing estimates have been derived from life history invariant approaches based on peer reviewed International science and have been shown previously to fall well within reported ranges from peer reviewed literature. Previous attempts to obtain maturity data did not deliver decisive results, due to the many factors affecting access to the necessary samples for direct observations. Limited data have also *not contradicted* existing estimates for any species to date.

Indonesian grey literature has also not contradicted estimates currently used for stock assessments and monitoring of trends in the snapper fisheries. Government partners however have specifically asked to further support the currently used estimates with actual data from Indonesian stocks. Therefore, a protocol has been developed which may deliver such data. It requires a significant investment in time, human resources and funds, to obtain useful information on a few of the main target species in the fisheries.

Maturity surveys will mainly collect data at fish processing plants, but take samples for specific size classes also from other sources, including directly from fishing boats, when certain categories are not available in the plants. The main target for the maturity surveys is *Lutjanus malabaricus*, the number 1 species in Indonesian snapper fisheries. Since plants that process *L. malabaricus* usually also process *Pristipomoides multidens*, the number 2 species, this will also be included. And finally, *P. multidens* is usually processed together with *P. typus*, the number 3 species, which will therefore also be included in the surveys.

The main target for maturity surveys will be females but males will follow automatically as sex cannot be determined externally. Three sex categories will be recorded based on macroscopic observations on gonads from target species: “female”, “male” and “unknown”. Access to the necessary samples is the main challenge, also when working with plants that regularly process these fish.

- Sufficient specimen will be needed *over the complete size range of each species*, from well below full maturity right up to the maximum size of the species. The lack of larger specimen in many studies, and the resulting lack of truly ripe and spawning fish in the samples, has led to under-estimation of L_{mat} in many cases. Under estimation of asymptotic size is often caused by the same problem, especially in heavily fished situations where large mature fish are rare.
- Sufficient specimen will be needed *over all seasons and all months of the year*, right through monsoon seasons, religious holiday months etc. When spawning takes place in monsoon seasons with rough weather, the access to fish may be very limited or even nihil. And when spawning seasons are short, they can be missed completely by missing just a few months of the year. Missing the spawning season may result in missing the opportunity to obtain the necessary gonad weight of truly ripe and mature fish.
- Sufficient specimen are needed *from all major fishing grounds in Indonesia* to be able to deal with debates around differences between fishing grounds and fisheries management areas, to better ensure that spawning areas are included in the fishing grounds which we are sampling from, and to have more chance to obtain data for

all months of the year across Indonesia. The latter of course only helps if spawning seasons are similar across the archipelago.

To ensure covering the complete size range for each species we will work with 12 size categories for all 3 species, including: <35cm, 35-39cm, 40-44cm, 45-49cm, 50-54cm, 55-59cm, 60-64cm, 65-69cm, 70-74cm, 75-79cm, 80-84cm and 85cm&up. For operational reasons it may be useful to quickly (roughly) relate size categories in terms of total length to size categories by weight, as commonly used in some of the processing plants. This can help to quickly see what size categories are available at any given time in a processing plant. NOTE these are indicative only:

- Malabar Under Sized = Under 1.8 kg = Under 50 cm.
- Malabar Small & Medium = 1.8 to 2.5 kg = 50 to 55 cm.
- Malabar Large = 2.5 kg and above = Above 55 cm.
- Gold Band Under Sized = Under 1.4 kg = Under 45 cm.
- Gold Band Small & Medium = 1.4 to 2.5 kg = 45 to 54 cm.
- Gold Band Large = Above 2.5 kg = 55 cm and above.
- Typus Under Sized = Under 0.9 kg = Under 45 cm.
- Typus Small & Medium = 0.9 to 2.5 kg = 45 to 60 cm.
- Typus Large = Above 2.5 kg = Above 60 cm.

A trained enumerator / site coordinator will live and work near the processing plant and landing sites for each sampling location. Continuous communication between enumerators, plant managers, suppliers and boat captains will ensure immediate reaction to availability of certain size classes by species at the plant or at the landing sites. It is anticipated that data collecting in the plants can take place without buying any fish, but samples of undersized fish may have to be purchased from fishers if these size classes are not available in the plants. Exceptional focus needs to be on obtaining samples of the larger fish.

A project leader is appointed for this work and this person will be responsible for development of the data set for this project. Additional coordinators remain in close contact with the enumerators in the field and stand by to visit locations as needed to keep the program on track. Location coordinators / enumerators communicate continuously with plant manager and boat captains and intermediate suppliers about landings, transport plans, receiving dates and times and most importantly processing dates, times and locations for specific species and size groups.

Focus will be *only* on the 3 target species mentioned above. Each enumerator has measuring board and precision weighing scale and camera with back up ready on site. Additional gear needs to be always in stock, including standard data forms, writing materials, post it for labels next to fish and gonads in photos, etc. Data need to be entered from forms into spreadsheets and sent to lead coordinators or project leader directly after recording, together with photos. A live report will be set up in IFish to follow progress.

When processing takes place at any time for a species and size group for which data are still needed in that month, the enumerator sets up in the processing plant right next to (before) the filleting team. Fish will be scaled first for skin-on fillets, but fish will be measured and weights will be taken only after scaling, just before filleting. Individual fish cannot be followed from before to after scaling.

Fish will be measured on the measuring board post scaling and if data are still needed that month for the specific species and size group (max 25 specimen per size group / species / month) then total length is recorded on the data form for that month / species / size category. If the size category is “full” then no further data are taken on that specimen and its size is not recorded.

Every month, at each sampling location (processing plant & supplying fisheries, see below) a maximum of 25 specimen per size class (as above) is investigated for each species. Sampling date, total length and total body weight as well as gonad weight and sex are all recorded on separate recording forms for each species and for each size group. Enumerators need a measuring board and a precision weighing scale on site. Each data form includes 25 records for one month, one species, and one size category of 5 cm. Data forms also need to include info on location of data collection and WPP where catch originated from. Enumerators at each location fill in a maximum of 36 data sheets each month from 3 species * 12 size categories. See further below (final pages) for draft recording forms.

For each specimen that is investigated, two (2) photos are made; one photo of the complete specimen on the measuring board (just before filleting, and after scaling if scaling takes place), and one of the gonads on the measuring board. Each photo includes a label (POST IT with written info) that identifies the specific specimen with (a) Species Code: LM, PM or PT, (b) Date (c) Size Category in cm (e.g. 50-54 cm) and (d) the ID number of the record on the data form. This links the photo to the record of the individual fish in the data base, allowing for later verification.

Intermediate results as well as other information on the data collection are presented live in this report.

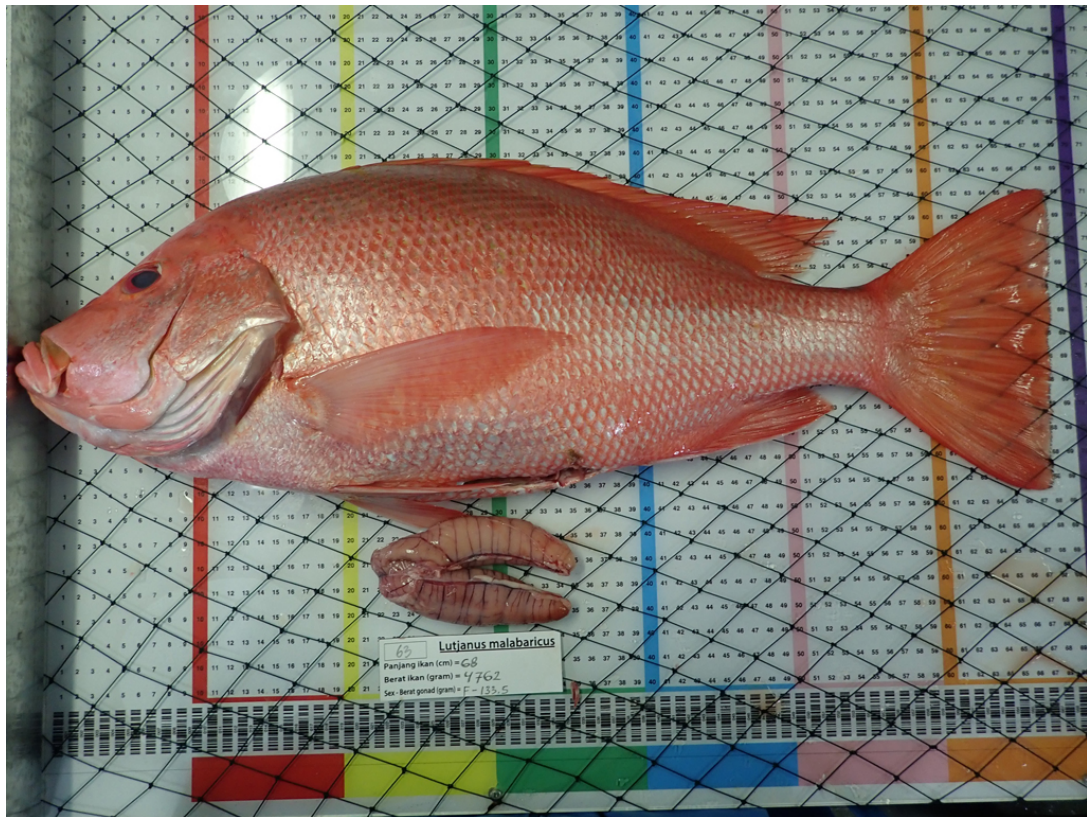


Figure 1.1: Fish with gonad are photographed by technicians at the processing plant as part of gonad data collection



Figure 1.2: Gonad on the weighing scale photographed by technicians at the processing plant as part of gonad data collection

Table 1.1: Number of fish sampled per species, per WPP

Species Name	713	715	718
Lutjanus malabaricus	835	0	266
Pristipomoides multidens	509	9	508
Pristipomoides typus	475	5	296

Table 1.2: Number of fish sampled per month, per species

Sampling Period	Lutjanus malabaricus	Pristipomoides multidens	Pristipomoides typus
September 2019	1	11	12
October 2019	93	136	115
November 2019	189	185	112
December 2019	177	96	64
January 2020	44	88	82
February 2020	173	137	74
March 2020	180	211	208
April 2020	120	46	43
May 2020	114	46	23
June 2020	0	54	27
July 2020	10	16	16

Table 1.3: Number of fish sampled in total (over all months), by 5 cm size class
 (the numbers are the lower boundary of each size class)

Size Class	Lutjanus malabaricus	Pristipomoides multidens	Pristipomoides typus
30	3	1	0
35	15	132	44
40	96	242	206
45	208	315	228
50	210	137	186
55	229	73	63
60	192	85	39
65	106	38	8
70	34	3	2
75	8	0	0

Table 1.4: Tables with number of fish sampled by species, and by month in PT. Kemilau Bintang Timur

Sampling Period	Lutjanus malabaricus
October 2019	42
November 2019	92
December 2019	124
January 2020	5
February 2020	134
March 2020	112
April 2020	120
May 2020	100

Table 1.5: Tables with number of fish sampled by species, and by month in PT. Sukses Lautan Indonesia

Sampling Period	Lutjanus malabaricus	Pristipomoides multidens	Pristipomoides typus
November 2019	4	45	41
December 2019	15	71	64
January 2020	30	79	78
February 2020	24	77	21
March 2020	20	38	26
May 2020	14	46	23
June 2020	0	53	20

Table 1.6: Tables with number of fish sampled by species, and by month in PT. Sukses Hasil Alam Nusaindo

Sampling Period	Lutjanus malabaricus	Pristipomoides multidens	Pristipomoides typus
September 2019	1	11	12
October 2019	28	136	115
November 2019	19	86	67
February 2020	0	40	33
March 2020	48	173	182
April 2020	0	46	43
June 2020	0	1	7
July 2020	10	16	16

Table 1.7: Tables with number of fish sampled by species, and by month in PT. Kelola Laut Nusantara

Sampling Period	Lutjanus malabaricus	Pristipomoides multidens	Pristipomoides typus
October 2019	23	0	0
November 2019	74	54	3
December 2019	38	25	0
January 2020	9	0	0
February 2020	15	20	20

Table 1.8: Tables with number of fish sampled by species, and by month in PT. Tunas

Sampling Period	Pristipomoides multidens	Pristipomoides typus
November 2019	0	1
January 2020	9	4

