Sustainable aquaculture of a protected species: The case of juvenile humphead wrasse (*Cheilinus undulatus*) around the Anambas Islands

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**Abstract.** Humphead wrasse (*Cheilinus undulatus*), also called napoleon fish or “katepas” in Anambas Archipelago Regency, Indonesia, is a reef fish which commonly found in tropical seas. Napoleon fish exploitation is still getting higher especially in Indonesia. Nevertheless, this species had listed as a protected species by the Indonesian Government as well as enlisted in Appendix II of CITES (Convention on International Trade in Endangered Species). Following a dialog among Indonesian officials, FAO and CITES, quota permission has been given to the fisherman community of Anambas Regency. This permission was legally allowed the Anambas Fishermen to fishing the napoleon fish juveniles and reared them in floating net cages for 3-4 years to reach commercial size. About 147,000 napoleon fish were estimated to be reared in Anambas Island. The first export of Napoleon fish was recorded in 2018 by one of the Indonesian fish exporters from Anambas to Hong Kong with 1,000 fish or Rp 1 billion worth and equivalent to $ USD 71.4/kg. The aim of this research was to analyse spatial distribution, juveniles abundance and water quality of the Anambas Islands to improve the sustainability of napoleon fish juveniles resources. Juveniles and water quality data were collected during field survey in 2014 and 2015. The abundance of the juvenile was estimated from monthly data recording by fishermen and water samples were measured *in-situ*. Post to the measurement of the physical and chemical properties, water quality was determined by using the National Sanitation Foundation Water Quality Index (NSF-WQI) based on The Classification of the Index numerical values. The results showed that napoleon fish juveniles were concentrated in several specific locations around Anambas waters. The highest abundance of napoleon fish juvenile was observed in November and December. The waters quality indexes show good and very good conditions for culturing the juvenile in floating net cages. The success in napoleon fish juvenile rearing is a starting point to achieve the fish sustainable aquaculture-based fisheries management. This research concludes that the identified natural rearing areas of juvenile napoleon fish, good water conditions, and improved existing rearing technology might support sustainable ranching-based aquaculture of humphead wrasse in Anambas Islands waters.

**Keywords:** Anambas, existence, humphead wrasse, juvenile, mariculture

1. **Introduction**

Napoleon fish (*Cheilinus undulatus*) is a highly valued fish species in international life reef fish trade (LRFT) markets which can reach between 1.05 million [1] to 1.2 million rupiahs [2] per kg weight. High prices and market demand were becoming the main reasons for the overexploitation population of napoleon fish resources.
The availability of Napoleon fish resources in the Anambas waters was sufficient to maintain a healthy wild stock population and also supplied fishing activities in the era before the 1990s [3, 4]. After that period, there was a significant decline in the abundance and catch of napoleon fish leading to capture of napoleon fish juvenile to be raised in the floating net cage system (KJA) until it reaches the size of consumption [3, 4]. Intensive and uncontrolled fish resources exploitation were usually lead to overfishing capture activities and fisheries crisis [5].

The addition of fishery inputs (capital, fishing vessel, technology, number of fishermen) can drive the production system from stable to an unstable condition which is indicated by the high pressure on fish resources [5]. Fisheries production based on the traditional system was lack of technology in achieving higher productivity by using limited resources (e.g., juvenile availability), thus, in a traditional system, the natural resources were still becoming an important factor for the production success [6]. This is what distinguishes between capture fisheries and mariculture production systems, where the latter only relies on seed supply from hatchery production systems in a controlled condition.

Fisheries management is developed based on biological and ecological information and data on commodity characteristics, especially fish stocks. Today, Information regarding the prospects of napoleon fish is limited. Several essential information about the characteristics of the population such as distribution and relation to their habitat is important to acquire. Furthermore, the spatial distribution of juveniles needs to be known to maintain the sustainability of their use. Thus, our research was aimed to analyse the spatial distribution, juvenile abundance and water quality conditions in Anambas Archipelagic waters to improve the sustainability of napoleon fish aquaculture.

2. Materials and methods
The study was conducted during 2014-2015 through field visits, sampling, and interviews around the Anambas Islands District. The observation was included 16 sampling sites for water quality data acquisition and 30 fishermen as the source person in gathering local information. The abundance of the juvenile was estimated from monthly data recording by fishermen collectors. Water samples were analysed using Water Quality Checker (YSI) with several water parameters recorded, i.e., temperature, turbidity, ORP, conductivity, DO, TDS, pH, and salinity in situ. Water transparency was estimated using secchi disk while current speed and direction were estimated using the current meter (Patent No. IDS000001894). All related parameters were calculated using the weighted arithmetic index method, then determined by using the National Sanitation Foundation Water Quality Index (NSF-WQI) based on The Classification of the Index numerical values [7, 8]. The relationship between various water quality variables was analysed using Principal Component Analysis (PCA). The growth rates of the juvenile of napoleon fish reared in floating net cage were monitored and measured using the following method. In April 2015, the initial measurements used 15 napoleon fish juveniles kept in one of the net pens of the floating cage. Afterward, as many as 95 juvenile napoleon fish were measured their length and weight and repeated for each month for six months period. The fish juveniles were fed with shells removed-and-crushed crustaceans.

3. Results
3.1. Napoleon fish juveniles distribution
The monthly analysed data from the enumerators showed that 1,513 juveniles napoleon fish were collected from fishermen catches around the Anambas Islands (Table 1). Juvenile capture location, water quality data collection and KJA position are presented in the distribution map.

| No | Location | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Total |
|----|----------|---|---|---|---|---|---|---|---|---|----|----|----|------|
| 1  | Batu Koran | 9 | 5 | 7 |   | 10 |   |   |   |   |    |    |    | 31   |
| 2  | Ganjo | 3 |   |   |   |   |   |   |   |   |    |    |    | 3    |

Table 1. The catch of napoleon fish juveniles for 12 months in several locations around the waters of the Anambas Islands in 2015.
The data also shows that the catching activities were dominantly carried out at the beginning and end of the year. The favourite locations were Batu Belah, Karang Panjang, Mempauk, and Tembuk islands.
Catching activities for napoleon fish juveniles in 2014 and 2015 were also carried out in the surrounding areas of existing floating cages. Table 2 below presents the catching activities around the existing net cage.

Table 2. The fishing ground area for napoleon fish juveniles in 2014-2015 near the location of the existing floating cages of Anambas Islands.

| No. | Position (° N) | Position (° E) | Locations               | Year |
|-----|---------------|---------------|-------------------------|------|
| J01 | 3.21017       | 106.31517     | Tekoran                 | 2015 |
| J02 | 3.21630       | 106.30140     | Selatan Telukpau        | 2014 |
| J03 | 3.21627       | 106.30138     | Telukpau                | 2014 |
| J04 | 3.23060       | 106.30760     | Timur Telukpau          | 2014 |
| J05 | 3.23910       | 106.30580     | Utara Telukpau          | 2014 |
| J06 | 3.24010       | 106.30000     | Selatan Airasuk         | 2014 |
| J07 | 3.24940       | 106.30240     | Lidi                    | 2014 |
| J08 | 3.25240       | 106.31080     | Pulau Sempit            | 2014 |
| J09 | 3.22100       | 106.29500     | Tanjung Ikan            | 2014 |
| J10 | 3.22489       | 106.29039     | P.Tembuk                | 2015 |
| J11 | 3.22840       | 106.29150     | P.Tembuk                | 2014 |
| J12 | 3.23248       | 106.29592     | Teluk Uyun              | 2015 |
| J13 | 3.23210       | 106.29900     | Tanjung Datok           | 2014 |
| J14 | 3.23153       | 106.28869     | Telukpau                | 2015 |
| J15 | 3.23766       | 106.28970     | Airsena                 | 2014 |
| K01 | 3.24950       | 106.28090     | Airsena                 | 2015 |
| K02 | 3.23240       | 106.28640     | Telukpau                | 2015 |
| K03 | 3.23670       | 106.30220     | Telukpau                | 2015 |
| K04 | 3.23260       | 106.31870     | Telukpau                | 2015 |
| K05 | 3.21920       | 106.32030     | Telukpau                | 2015 |
| K06 | 3.24780       | 106.31680     | Telukpau                | 2015 |
| K07 | 3.21980       | 106.28510     | Telukpau                | 2015 |
| K08 | 3.22240       | 106.27300     | Telukpau                | 2015 |
| K09 | 3.21280       | 106.29870     | Telukpau                | 2015 |
| K10 | 3.20860       | 106.30990     | Telukpau                | 2015 |
| K11 | 3.21810       | 106.30070     | Telukpau                | 2015 |
| K12 | 3.23970       | 106.30780     | Telukpau                | 2015 |
| K13 | 3.22260       | 106.29210     | Telukpau                | 2015 |
| K14 | 3.22590       | 106.28480     | Telukpau                | 2015 |
| K15 | 3.21680       | 106.29510     | Telukpau                | 2015 |
| K16 | 3.23510       | 106.28630     | Telukpau                | 2015 |
| KJA-1| 3.22915       | 106.28608     | Tanjung Datok           | 2015 |
| KJA-2| 3.25060       | 106.28010     | Airsena                 | 2015 |
| KJA-3| 3.22720       | 106.26770     | Selat Peninting         | 2015 |
| KJA-4| 3.24950       | 106.28000     | Airsena                 | 2015 |

Note: J01 – J16 are napoleon nursery areas, KJA-3 is KJA from Selat Peninting, K01 – K16 are sampling sites for water quality, KJA-4 is KJA from Airsena, KJA-1 is the KJA from Tanjung Datok, KJA-2 is KJA from Airsena,
3.2. Napoleon fish juvenile abundance and total rainfall

Based on the 2014 data collection, the total number of caught juvenile of napoleon fish in the Anambas Islands District was 30,918 individuals. The data showed that a high abundance of napoleon juveniles was observed in October and November. Meanwhile, the rainfall in Anambas district showed high intensity in October, November, and December of 2014 ranging between 250 - 500 mm. The highest wind speed was recorded only in January reaching up to 7 knots and only up to 5 knots from February to December. The wind direction in January to March dominantly blew to North direction, from April to November to South direction and back to the North in December (Table 3).

| Month    | Abundance (individual) | Rainfall (mm) |
|----------|------------------------|---------------|
| January  | 110                    | 193.1         |
| February | 130                    | 0.2           |
| March    | 125                    | 84.7          |
| April    | 166                    | 73.2          |
| May      | 128                    | 170.3         |
| June     | 146                    | 84.3          |
| July     | 37                     | 72.6          |
| August   | 85                     | 163.5         |
| September| 1,647                  | 105.3         |
| October  | 11,354                 | 300.5         |
| November | 16,868                 | 352.5         |
| December | 122                    | 544.5         |
| Total    | 30,918                 | 2,144.7       |

3.3. Napoleon's fishery business activities

Fishermen in Anambas Islands catch adult napoleon fish with fishing hook and fishing nets in the 1980s where adult napoleon fish were still abundant. Currently, adult napoleon fish are increasingly rare and difficult to catch. Now, napoleon fishing activities have shifted the target to catch juvenile Napoleon fish in the shallow coral reef ecosystem, particularly in areas of seagrass beds (*Sargassum* spp.). The juveniles are then reared in floating net cages. Most fishermens, collectors, and growers of napoleon fish juveniles have been involved in this business activity for 5-10 years. The locations of the fishing area for juvenile and floating cages of napoleon fish are presented in Figure 1.
3.4. Water quality around the juvenile nursery ground area

Water quality parameters taken during a sampling survey in April 2015 are presented in Appendix 1-Table 1. The results of the PCA of these parameters show two groups of observations that have relatively similar characteristics regarding the water quality variations. At observation sites 3, 4, 5, 6, 7, and 8 the current speed tended to be high, but relatively low turbidity. These locations are located slightly outside the bay with relatively deeper water depths. At observation points 11, 12, 13, 14, 15, and 16, turbidity and ORP values tended to be relatively high and relatively varied in current speed. This location is generally located in the strait of several small islands and the shallow water depth. The full data is presented in Appendix 1.

3.5. Survival rate of the napoleon fish juvenile

There were 103 data points from the measurement of the length, and weight of the juvenile of Napoleon fish reared in the floating net cage from April to October 2015 (Figure 2 and Table 4).
Figure 2. The growth of napoleon fish juveniles after being reared for six months and their length-weight relationship (n = 103).

Table 4. The growth characteristics of napoleon fish juvenile reared in the floating nets cages for six months in 2015 in Anambas waters

| Month      | Average of total length (cm) | Average of weight (g) | Length gain (cm) | Weight gain (g) |
|------------|------------------------------|-----------------------|------------------|-----------------|
| April      | 4.7                          | 1.9                   | 0.91             | 1.86            |
| May        | 5.6                          | 3.7                   | 0.41             | 0.05            |
| June       | 6.1                          | 3.8                   | 0.12             | 0.01            |
| July       | 6.8                          | 5.1                   | 0.22             | 0.40            |
| August     | 8.2                          | 9.3                   | 1.30             | 4.20            |
| September  | 8.7                          | 10.7                  | 0.73             | 1.40            |
| October    | 8.8                          | 12.5                  | 0.09             | 1.80            |
| average    | 7.0                          | 6.7                   | 0.70             | 1.80            |
| minimum    | 4.7                          | 1.9                   | 0.10             | 0.00            |
| maximum    | 8.8                          | 12.5                  | 1.40             | 4.20            |

The growth of Napoleon juveniles reared in the floating net cages is presented in Figure 2. The data shows that the average gain of length and weight was 0.7 cm/month and 1.8 g/month, respectively. The smallest individual fish size was 4.7 cm and 1.9 grams in initial and grows to the largest size was 8.8 cm and 12.5 grams after reared for seven months. The relationship between the length-weight of the napoleon juvenile obtained from the 103 data point can be represented by a linear equation of \( Y = 0.0343X^{2.646} \) with a coefficient of determination of \( R^2 = 0.9274 \) (Figure 2). Of the 95 reared juveniles, 85 fish survived at the end of the observation (May 2015) or 89% survival rate. Rearing activities and the length and weight measurements of Napoleon juveniles are presented in Figure 3.
Figure 3. Measurement activities of napoleon fish juveniles reared in the floating nets cages of Air Sena waters, Anambas Regency [juvenile of Napoleon fish reared in KJA (No.1); juvenile of napoleon fish sized 1.1 cm (No.2); juvenile of napoleon fish sized 2.7 cm (No.3); juvenile of napoleon fish sized 7.8 cm (No.4); and napoleon fish reared in KJA sized 20-30 cm (No.5)] around the waters of Anambas Islands.

4. Discussion

4.1. Relationship of napoleon fish juvenile abundance and rainfall

The relationship between the abundance of Napoleon fish juvenile data with rainfall data in 2015 is relatively uncorrelated. However, the datasets for 2014 show that the juveniles abundance tended to follow the increase of rainfall [4]. The data during the twelve months showed an increased juvenile abundance in October and November following the increase of rainfall [9]. The relationship between the two data sets is presented in Figure 4.
4.2. The success of KJA napoleon fish in Anambas

The abundance of napoleon juveniles that occur every year in the shallow waters of Anambas Islands has well known for decades. This resource feeds the development of napoleon fish culture in the area. At least, the past four years have shown the relative success of ranching aquaculture in Anambas waters. The current utilization of wild juveniles of napoleon fish has been on a balanced level for many years and still is until now. However, when overutilization occurs, the sustainability of wild juvenile populations will be disrupted leading to serious and tight control and management of the resources.

The water quality of the habitat of napoleon fish is within the range of optimum values due to limited potential sources of pollution and the location of Anambas in the open sea of the South China Sea. The variation of water quality conditions and water quality index are provided in Table 5.

Table 5. Water quality index in the fishing grounds of Napoleon juveniles and floating net cage, Anambas Islands.

| Site | Location | °N | °E   | Salinitas (‰) | DO (mg/l) | pH | Turbidity (NTU) | Water Quality Index | Water Quality Rating |
|------|----------|----|------|---------------|-----------|----|------------------|---------------------|---------------------|
| 1    | Telukpau | 3.2495 | 106.2809 | 34.06         | 3.60      | 7.92 | 1.17             | 70.58               | Good                |
| 2    | Telukpau | 3.2324 | 106.2864 | 34.20         | 4.18      | 8.21 | 1.27             | 74.91               | Good                |
| 3    | Telukpau | 3.2367 | 106.3022 | 34.45         | 4.20      | 8.27 | 0.87             | 74.84               | Good                |
| 4    | Telukpau | 3.2326 | 106.3187 | 34.44         | 6.61      | 8.29 | 0.38             | 91.55               | Excellent           |
| 5    | Telukpau | 3.2192 | 106.3203 | 34.45         | 4.71      | 8.30 | 0.68             | 80.09               | Good                |
| 6    | Telukpau | 3.2478 | 106.3168 | 34.45         | 5.59      | 8.32 | 0.51             | 87.33               | Good                |
| 7    | Telukpau | 3.2198 | 106.2851 | 34.40         | 6.19      | 8.32 | 0.86             | 89.82               | Good                |
| 8    | Telukpau | 3.2224 | 106.2730 | 34.46         | 5.12      | 8.33 | 0.47             | 83.65               | Good                |
| 9    | Telukpau | 3.2128 | 106.2987 | 34.42         | 4.10      | 8.11 | 2.19             | 73.94               | Good                |
| 10   | Telukpau | 3.2086 | 106.3099 | 34.45         | 5.22      | 8.20 | 0.95             | 85.29               | Good                |
| 11   | Telukpau | 3.2181 | 106.3007 | 34.40         | 4.92      | 8.21 | 2.82             | 81.65               | Good                |
| 12   | Telukpau | 3.2397 | 106.3078 | 34.37         | 4.51      | 8.30 | 1.97             | 77.39               | Good                |
| 13   | Telukpau | 3.2226 | 106.2921 | 34.49         | 4.82      | 8.30 | 1.10             | 80.88               | Good                |
| 14   | Telukpau | 3.2259 | 106.2848 | 34.44         | 5.19      | 8.33 | 1.24             | 83.84               | Good                |
| 15   | Telukpau | 3.2168 | 106.2951 | 34.42         | 5.00      | 8.34 | 0.71             | 82.37               | Good                |
| 16   | Telukpau | 3.2351 | 106.2863 | 34.44         | 4.84      | 8.34 | 1.50             | 80.48               | Good                |
The results of the analysis of the main components of water quality variables indicate the grouping of areas that have characteristics of shallow water and strait areas shielded from bad weather. Other groups are strongly influenced by the characteristics of offshore waters. Generally, the location of the floating net is in shielded areas. This grouping pattern is presented in Figure 5.

**Figure 5.** Analysis of the principal components (PCA) of water quality parameters around Telukpau Island, Anambas Regency in 2015

Beneficial effects of successful culture for the Anambas fishermen with around 147,000 napoleon fishes in various sizes at 2015, and was permitted to export 1,000 napoleon fishes in 2018 [5]. The success of Anambas fishermen in rearing the juvenile of napoleon fish shows the promising beginning of the ecologically sustainable of aquaculture based on the general napoleon fisheries management in Anambas Island.

5. Conclusion

Napoleon fish resource management based on biological data and the local wild population is of importance to Anambas Island and other areas having similar resources. The continuous existence of juveniles and their sustainable use greatly influence the overall sustainability of the napoleon fisheries. Such a state within the aquaculture context can be achieved by balanced protection and use of the resource followed by effective regulation implementation. Preserving optimum water quality in napoleon fish's natural habitats will have a direct impact on maintaining a stable population of napoleon fish in these reservoir.

The success in juvenile rearing might serve as a good starting point to develop sustainably and maintaining the aquaculture-based fisheries management of napoleon fish. This research concludes that the identified natural rearing areas of juvenile napoleon fish, good water conditions, and improved existing rearing technology might support sustainable ranching-based aquaculture of humphead wrasse in Anambas Island.

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References

[1] KKP News 2018 *The First Export Value of Napoleon Fish Through the Sea Lines Reaches Rp 1 Billion.* Cooperation and Public Relations Bureau, Ministry of Maritime Affairs and Fisheries Accessed February 27, 2019 from https://news.kkp.go.id/index.php/nilai-ekspor-perdana-ikan-napoleon-lewat-jalur-laut-capai-rp1-miliar/
[2] D F W Indonesia 2013 *Urgent, Management of Napoleon Fish in the Anambas Islands* Accessed March 7, 2013 from http://dfw.or.id/mendesak-pengelolaan-ikan-napoleon-di-kepulauan-anambas/

[3] Dirhamsyah A M and Budiyanto B 2011 *Fisheries management plan (RPP): Moratorium on Napoleon fishing in Indonesian waters* [Academic Manuscript] (Indonesia: Research Center for Oceanography, Indonesian Institute of Sciences)

[4] Syam A R, Satria F, Tjahjo D W H and Putri M R A 2019 Napoleon fish (*Cheilinus undulatus*) resources management in Anambas Island Waters *Indonesian Fisheries Policy Journal* 11 75-87

[5] Fauzi A 2005 *Fisheries and Marine Policy: issues, Synthesis, and Ideas* (Jakarta: Gramedia)

[6] Monintja D R and Badruddin M 1996 *Provisions for the implementation of responsible fisheries (Code of conduct for responsible fisheries)* (Jakarta: Marine Fisheries Research and Development Center, Resources Evolution and Planning (MREP), Marine and Coastal Ecological System and Processes (MCESP))

[7] Brown R M, McClellan N I, Deininger R A and Tozer R G 1970 A water quality index-do we dare? *Water Sew Works* 117 339–343

[8] Sayadi M H and Ghaleno O R 2016 Study of water quality using NSFWQI in the year 2014 case study: Chahnimeh reservoir of Sistan *International Journal of Chemical Studies* 4 35-37

[9] Syam A R, Tjahjo D W H, Putri M R A, Mujiyanto and Rudi A 2014 Research on the determination of the protection status of Napoleon fish species (*Cheilinus undulatus*) in Anambas waters (Indonesia: Research Institute For Fisheries Resources Enhancement. Research and Development Technical Report 2014 Activities, RKP 09-KP 03-DP 06)
Appendix 1. The measurements data of water quality from fishing ground and culture areas of napoleon fish juvenile in the Floating net cages at Anambas Islands.

| No. of Sites | Depth (m) | Air temperature (°C) | Water temperature (°C) | Depth of secchi disk (%) | Conductivity (mScm) | Turbidity (NTU) | TDS (g/l) | ORP | Salinity (‰) | pH | DO (mg/l) | Current speed(m/det) | Current direction (°N) |
|--------------|-----------|----------------------|------------------------|--------------------------|---------------------|----------------|-----------|-----|-------------|----|-----------|----------------------|---------------------|
| 1            | 2         | 31.5                 | 31.5                   | 100                      | 58.65               | 1.17           | 33.87     | 9.3 | 34.06       | 7.92 | 3.6       | 0.114                | 185                 |
| 2            | 7.7       | 31.5                 | 30.3                   | 52                       | 57.63               | 1.27           | 34.06     | 0.2 | 34.2        | 8.21 | 4.18      | 0.367                | 177                 |
| 3            | 11.2      | 31                   | 29.8                   | 36                       | 57.28               | 0.87           | 34.13     | 1.7 | 34.45       | 8.27 | 4.2       | 0.344                | 239                 |
| 4            | 21.5      | 31                   | 29.7                   | 19                       | 57.21               | 0.38           | 34.13     | 1.59| 34.44       | 8.29 | 6.61      | 0.533                | 194                 |
| 5            | 18.3      | 30.5                 | 29.5                   | 22                       | 56.96               | 0.68           | 34.13     | 2.4 | 34.45       | 8.3  | 4.71      | 0.322                | 199                 |
| 6            | 15.1      | 30.5                 | 29.8                   | 26                       | 57.32               | 0.51           | 34.13     | 2.56| 34.45       | 8.32 | 5.59      | 0.386                | 191                 |
| 7            | 15.7      | 29.5                 | 29.5                   | 25                       | 56.88               | 0.86           | 34.06     | 1.58| 34.4        | 8.32 | 6.19      | 0.456                | 216                 |
| 8            | 7.5       | 29                   | 28.8                   | 53                       | 56.32               | 0.47           | 34.13     | 2.58| 34.46       | 8.33 | 5.12      | 0.519                | 247                 |
| 9            | 9.1       | 29.5                 | 28.8                   | 44                       | 56.27               | 2.19           | 34.06     | 13.8| 34.42       | 8.11 | 4.1       | 0.66                 | 250                 |
| 10           | 1.4       | 29.5                 | 29.2                   | 100                      | 0.06                | 0.95           | 34.13     | 10.5| 34.45       | 8.2  | 5.22      | 0.194                | 130                 |
| 11           | 1.4       | 30                   | 29.5                   | 100                      | 56.78               | 2.82           | 34.06     | 14.2| 34.4        | 8.21 | 4.92      | 0.049                | 339                 |
| 12           | 1.7       | 30                   | 30                     | 100                      | 57.57               | 1.97           | 34.06     | 12.1| 34.37       | 8.3  | 4.51      | 0.17                 | 228                 |
| 13           | 1.5       | 30                   | 29.2                   | 100                      | 56.71               | 1.10           | 34.13     | 12.4| 34.49       | 8.3  | 4.82      | 0.007                | 25                  |
| 14           | 1.7       | 29.5                 | 29                     | 100                      | 56.52               | 1.24           | 34.13     | 11.7| 34.44       | 8.33 | 5.19      | 0.038                | 252                 |
| 15           | 1.7       | 31                   | 28.8                   | 100                      | 56.28               | 0.71           | 34.06     | 13.01| 34.42       | 8.34 | 5        | 0.285                | 108                 |
| 16           | 1.6       | 28                   | 29                     | 100                      | 56.44               | 1.50           | 34.13     | 14.7| 34.44       | 8.34 | 4.84      | 0.031                | 315                 |