BUKTI KORESPONDENSI
ARTIKEL JURNAL NASIONAL

TERAKREDITASI B (58/DIKTI/Kep/2013)

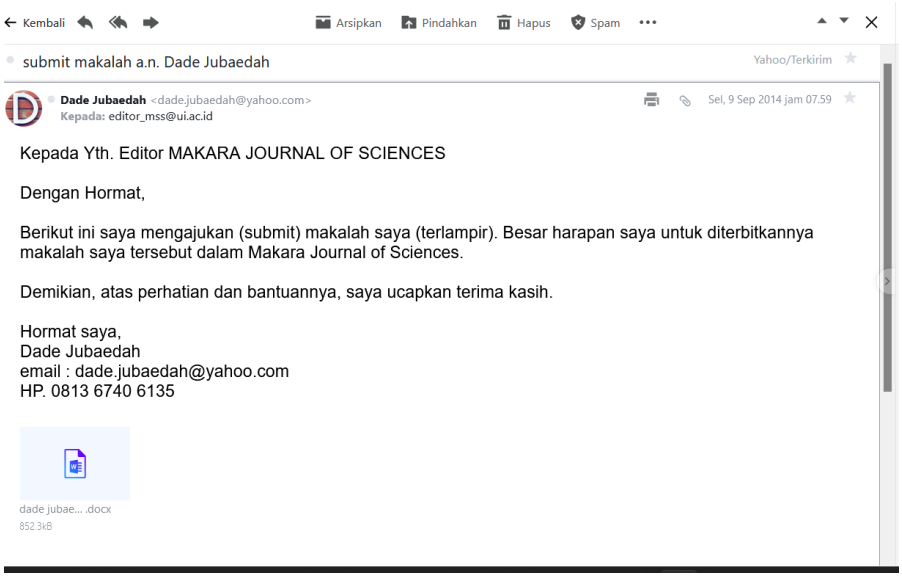
Judul Artikel : The Trophic Status of the Lubuk Lampam Floodplain in South Sumatera, Indonesia

Nama Jurnal : Makara Journal of Science, 20/2 (2016), 61-70

Penulis : Dade Jubaedah, Mohammad Mukhlis Kamal, Ismudi Muchsin, and Sigid Hariyadi

No	Perihal	Tanggal
1.	Bukti konfirmasi submit dan artikel yang disubmit	9 dan 11 September 2014
2.	Bukti email Journal Publishing Agreement (JPA)	12 September 2014
3.	Bukti review	12 November 2015
4.	Bukti revisi dan penerimaan hasil revisi	26 November 2015
5.	Bukti respon letter	8 Desember 2015
6.	Bukti perbaikan dari editor dan perbaikannya	10 dan 12 Desember 2015
7.	Bukti Proofreading dan perbaikannya	15 Januari 2016
8.	Bukti perbaikan proofreading	19 Januari 2016
9.	Bukti Acceptance Letter	29 Juni 2016

1. BUKTI KONFIRMASI SUBMIT DAN ARTIKEL YANG DISUBMIT (11 SEPTEMBER 2014)



Kembali | Arsipkan | Pindahkan | Hapus | Spam | •••

submit makalah a.n. Dade Jubaedah — Yahoo/Terkirim

Dade Jubaedah <dade.jubaedah@yahoo.com>
Kepada: editor_mss@ui.ac.id — Sel, 9 Sep 2014 jam 07.59

Kepada Yth. Editor MAKARA JOURNAL OF SCIENCES

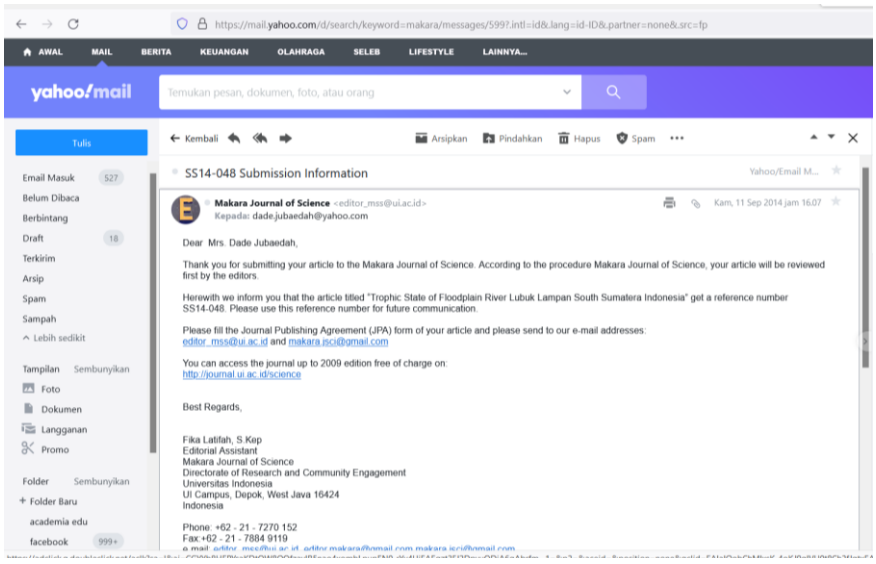
Dengan Hormat,

Berikut ini saya mengajukan (submit) makalah saya (terlampir). Besar harapan saya untuk diterbitkannya makalah saya tersebut dalam Makara Journal of Sciences.

Demikian, atas perhatian dan bantuannya, saya ucapkan terima kasih.

Hormat saya,
Dade Jubaedah
email : dade.jubaedah@yahoo.com
HP. 0813 6740 6135

dade jubae... .docx
852.3kB



https://mail.yahoo.com/d/search/keyword=makara/messages/599?.intl=id&.lang=id-ID&.partner=none&.src=fp

AWAL | MAIL | BERITA | KEUANGAN | OLAHRAGA | SELEB | LIFESTYLE | LAINNYA...

yahoo/mail — Temukan pesan, dokumen, foto, atau orang

Tulis

Email Masuk 527
Belum Dibaca
Berbintang
Draft 18
Terkirim
Arsip
Spam
Sampah
Lebih sedikit

Tampilan Sembunyikan
Foto
Dokumen
Langganan
Promo

Folder Sembunyikan
Folder Baru
academia edu
facebook 999+

Kembali | Arsipkan | Pindahkan | Hapus | Spam | •••

SS14-048 Submission Information — Yahoo/Email M...

Makara Journal of Science <editor_mss@ui.ac.id>
Kepada: dade.jubaedah@yahoo.com — Kam, 11 Sep 2014 jam 16.07

Dear Mrs. Dade Jubaedah,

Thank you for submitting your article to the Makara Journal of Science. According to the procedure Makara Journal of Science, your article will be reviewed first by the editors.

Herewith we inform you that the article titled "Trophic State of Floodplain River Lubuk Lampan South Sumatera Indonesia" get a reference number SS14-048. Please use this reference number for future communication.

Please fill the Journal Publishing Agreement (JPA) form of your article and please send to our e-mail addresses:
editor_mss@ui.ac.id and makara.jsci@gmail.com

You can access the journal up to 2009 edition free of charge on:
http://journal.ui.ac.id/science

Best Regards,

Fika Latifah, S.Kep
Editorial Assistant
Makara Journal of Science
Directorate of Research and Community Engagement
Universitas Indonesia
UI Campus, Depok, West Java 16424
Indonesia

Phone: +62 - 21 - 7270 152
Fax.+62 - 21 - 7884 9119

Trophic State of Floodplain River Lubuk Lampam South Sumatera Indonesia

Dade Jubaedah[1,2)], M. Mukhlis Kamal[2,3)], Ismudi Muchsin[2)], Sigid Hariyadi[2)]

[1)]Study Program of Aquaculture, Faculty of Agriculture, Sriwijaya University, Palembang, 30662, Indonesia
[2)]Departement of Aquatic Resources Management, Faculty of Fisheries and Marine Sciences, Bogor Agricultural University, Bogor 16680, Indonesia

[3)]*E-mail : m_mukhliskamal@yahoo.com*, phone/fax. : 0251-622932/0251-8622907

Abstract

Trophic state of Lubuk Lampam floodplain river was affected by natural change of water level fluctuation. The ecosystem also receives substantial load of nutrient and other chemical resulting from the anthropogenic activities, especially from oil palm plantation and it's industrial processing. The main objective of this research was to determine trophic state of the floodplain river area using Carlson's trophic state index (TSI) and trophic level index (TLI). The water quality and fish samples were collected and analysed from 7 stations that representing types of habitat of the floodplain. The results show that based on the two methods, the trophic state of Lubuk Lampam were hypereutrophic. This trophic status was supported by the substantial additional weight and gonado somatic index (GSI) of fish sampel.

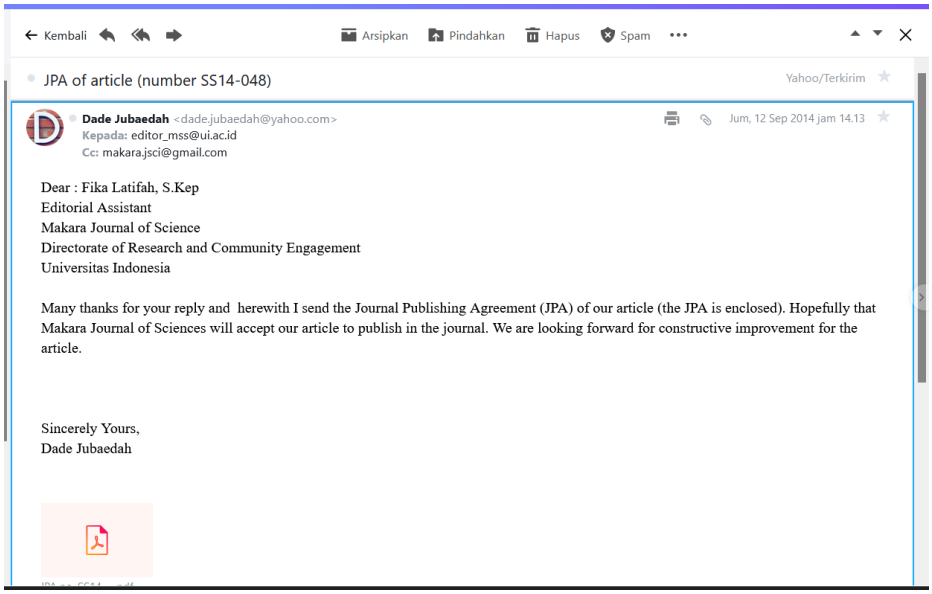
Key words : floodplain rivers, trophic state, Lubuk Lampam

Abstrak

Rawa banjiran Lubuk Lampam merupakan ekosistem yang secara alamiah dipengaruhi oleh perubahan muka air. Ekosistem ini juga menerima bahan masukan antropogenik berupa nutrien dan bahan kimia pertanian terutama dari perkebunan kelapa sawit dan industri pengolahannya. Penelitian ini bertujuan untuk menentukan status trofik untuk rawa banjian menggunakan *Trophic State Index* (TSI) dari Carlson dan *Trophic Level Index* (TLI). Pengambilan dan analisis contoh air dan ikan pada 7 stasiun contoh yang mewakili tipe habitat rawa banjiran. Berdasarkan dua formula indeks tersebut diperoleh hasil yang menunjukkan bahwa Lubuk Lampam berada dalam status hypereutrofik (sangat subur). Indikasi kesuburan juga ditunjukkan dengan pertambahan berat ikan yang tinggi dan indeks kematangan gonad ikan (*Gonado Somatic Index*, GSI) yang cukup besar.

Kata Kunci : Rawa banjiran, status trofik, Lubuk Lampam

2. Bukti email Journal Publishing Agreement (JPA) (12 September 2014)



Kembali Arsipkan Pindahkan Hapus Spam

JPA of article (number SS14-048) Yahoo/Terkirim

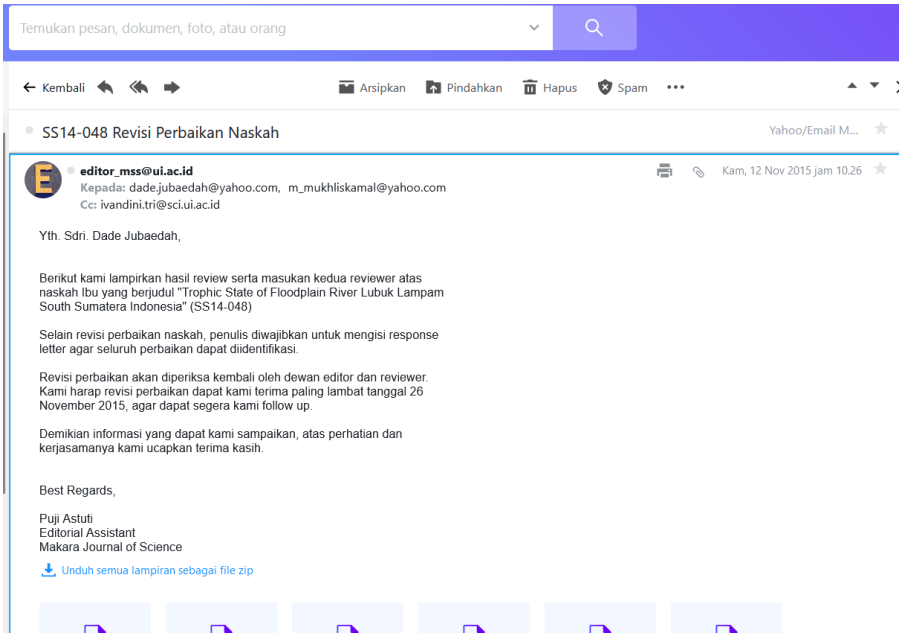
Dade Jubaedah <dade.jubaedah@yahoo.com>
Kepada: editor_mss@ui.ac.id
Cc: makara.jsci@gmail.com
Jum, 12 Sep 2014 jam 14.13

Dear : Fika Latifah, S.Kep
Editorial Assistant
Makara Journal of Science
Directorate of Research and Community Engagement
Universitas Indonesia

Many thanks for your reply and herewith I send the Journal Publishing Agreement (JPA) of our article (the JPA is enclosed). Hopefully that Makara Journal of Sciences will accept our article to publish in the journal. We are looking forward for constructive improvement for the article.

Sincerely Yours,
Dade Jubaedah

3. Bukti review (12 November 2015)



Temukan pesan, dokumen, foto, atau orang

Kembali | Arsipkan | Pindahkan | Hapus | Spam | •••

SS14-048 Revisi Perbaikan Naskah — Yahoo/Email M...

editor_mss@ui.ac.id — Kam, 12 Nov 2015 jam 10.26
Kepada: dade.jubaedah@yahoo.com, m_mukhliskamal@yahoo.com
Cc: ivandini.tri@sci.ui.ac.id

Yth. Sdri. Dade Jubaedah,

Berikut kami lampirkan hasil review serta masukan kedua reviewer atas naskah Ibu yang berjudul "Trophic State of Floodplain River Lubuk Lampam South Sumatera Indonesia" (SS14-048)

Selain revisi perbaikan naskah, penulis diwajibkan untuk mengisi response letter agar seluruh perbaikan dapat diidentifikasi.

Revisi perbaikan akan diperiksa kembali oleh dewan editor dan reviewer. Kami harap revisi perbaikan dapat kami terima paling lambat tanggal 26 November 2015, agar dapat segera kami follow up.

Demikian informasi yang dapat kami sampaikan, atas perhatian dan kerjasamanya kami ucapkan terima kasih.

Best Regards,

Puji Astuti
Editorial Assistant
Makara Journal of Science

Unduh semua lampiran sebagai file zip

REFEREE'S REPORT

Reference Number : SS14-048

Title : Trophic State of Floodplain River Lubuk Lampam South Sumatera Indonesia

Instructions for Referees

Please provide an overall assessment of the paper and provide answers to the following questions. Detailed comments and recommendations should not be written in the text, but should be numerically listed on separate sheets of paper that do not reveal your identity or affiliation. Minor wording or grammatical changes can be indicated in red pen or pencil in the text.

A. Please give your *appreciation of the scientific interest and novelty* of results described
(in Indonesia or in English)

This writing is not something new, but the ecological analysis that covered many approach and methods is something valuable.

B. Style and Organization (Please check as appropriate) **Double Click**

1.	Is it clearly presented, well organized, and clearly written?	☒ Yes ☐ No
2.	Does it contain superfluous material?	☐ Yes ☒ No
3.	Is the title appropriate?	☒ Yes ☐ No
4.	Does the abstract include the important points of the paper	☒ Yes ☐ No
5.	If applicable, is the experiment section sufficiently detailed?	☒ Yes ☐ No
6.	Is sufficient information included or cited to support the assertions made and conclusions drawn?	☒ Yes ☐ No
7.	Are references to related work adequate, up to date and readily available?	☒ Yes ☐ No
8.	Are the illustrations and tables all necessary and adequate?	☒ Yes ☐ No
9.	Are the figure and table captions complete and accurate?	☒ Yes ☐ No

10. Are the conclusions satisfactory, sound and justified ☒ Yes ☐ No
11. Do you agree with the "Prime Novelty" as indicated (by the author)? ☐ Yes ☒ No

    Why or why not? No novelty but the data complete enough

    ……

12. Does the manuscript contain original and self-consistent ideas? ☒ Yes ☐ No
    Please comment ……..

    ……

13. Does the manuscript contain subject matter that might/should be omitted? ☐ Yes ☒ No
    If so, what? ……..

    ……

14. For manuscript in English, Is the English satisfactory? ☒ Yes ☐ No

C. Quality and Assessment
(Please check as appropriate)

☐ Makes major contributions to the advancement of the subject
☒ Sound, original, and of interest
☐ Sound, original, but not suitable for Makara Seri Sains
☐ Does not add to knowledge of the subject
☐ Contains fundamental errors or faulty judgements

D. Referee's Recommendation
(Please check all boxes that apply)

☐ Acceptable in present form
☐ Acceptable with grammatical revision
☒ Acceptable with minor technical revision
☐ Acceptable with major technical revision
☐ Submit to further refereeing :
(Suggest name of referee) ……..
☐ Reject

Check here if you want to see the Revised Version ☐

Check here if you made annotation on the manuscript ☐

E. Timeliness of Research	☐ New	☒ Somewhat New	☐ Old
F. Scientific Impact	☐ High	☒ Moderate	☐ No Impact
G. Match between title,	☐ Excellent	☒ Good	☐ Poor

abstract, data and conclusions

H. Rate scientific novelty to the community	☐ High	☒ Medium	☐ Low
I. Rate the interest to the community	☐ High	☒ Medium	☐ Low

J. Remarks/Additonal Comments (if any)

(in Indonesia or in English)

REFEREE'S REPORT

Reference Number : SS14-048

Title : Trophic State of Floodplain River Lubuk Lampam South Sumatera Indonesia

Instructions for Referees
Please provide an overall assessment of the paper and provide answers to the following questions. Detailed comments and recommendations should not be written in the text, but should be numerically listed on separate sheets of paper that do not reveal your identity or affiliation. Minor wording or grammatical changes can be indicated in red pen or pencil in the text.

E. Please give your *appreciation of the scientific interest and novelty* of results described
(in Indonesia or in English)

This is a good research topic and also new information regarding trophic status of Lubuk Lampam.

F. Style and Organization (Please check as appropriate)

7.	Is it clearly presented, well organized, and clearly written?	☒ No
8.	Does it contain superfluous material?	☒ No
9.	Is the title appropriate?	☒ Yes
10.	Does the abstract include the important points of the paper	☒ Yes
11.	If applicable, is the experiment section sufficiently detailed?	☒ Yes
12.	Is sufficient information included or cited to support the assertions made and conclusions drawn?	☒ Yes
15.	Are references to related work adequate, up to date and readily available?	☒ Yes
16.	Are the illustrations and tables all necessary and adequate?	Not really
17.	Are the figure and table captions complete and accurate?	☒ Yes
18.	Are the conclusions satisfactory, sound and justified	Not really
19.	Do you agree with the "Prime Novelty" as indicated (by the author)?	☒ Yes

Why or why not? Because there was no report about the trophic status of Lubuk Lampam.

……

20. Does the manuscript contain original and self-consistent ideas? ☒ Yes
    Please comment: Judging from the references, apparently this is an original work although it is not a new idea since this kind of research has been conducted in several floodplains in the world. However, it will be very usefull for Lubuk lampam management.

    ……

21. Does the manuscript contain subject matter that might/should be omitted? ☒No
    If so, what? …….

    ……

22. For manuscript in English, Is the English satisfactory? ☒No

G. Quality and Assessment
(Please check as appropriate)

☐ Makes major contributions to the advancement of the subject
☐ Sound, original, and of interest

H. Referee's Recommendation
(Please check all boxes that apply)

☐ Acceptable with grammatical revision
☒ Acceptable with major technical revision

Check here if you made annotation on the manuscript
☐

E. Timeliness of Research ☒ New

F. Scientific Impact ☒ High

G. Match between title, abstract, data and conclusions ☒ Good

H. Rate scientific novelty to the community ☒ High

I. Rate the interest to the community ☒ High

J. Remarks/Additonal Comments (if any)

(in Indonesia or in English)

1. Pembahasan tulisan ini lebih dititik beratkan pada kualitas air (dalam hal ini TSI dan TLI), sedangkan pembahasan biologi ikannya sangat kurang. Padahal, subur tidaknya suatu perairan dapat diungkapkan melalui kondisi ikan-ikan yang ada di perairan tersebut.
2. Biologi ikan, dalam hal ini hubungan berat-panjang ikan dan GSI (Indeks Kematangan Gonad) perlu dibahas lebih rinci, antara lain berdasarkan *sex* dan *cluster*.
3. Pembahasan kurang mendalam. Memang banyak daftar pustaka yang disitir, tetapi sayang kurang dilibatkan dan dihubungkan dengan hasil penelitian.
4. Ada pernyataan yang bertolak belakang; hal ini perlu diluruskan. Komentarnya langsung ditulis dalam naskah dengan menggunakan facilitas “Track changes”.
5. Figure 3-7: sebaiknya berwarna. *Bars* yang monochrome sulit dibedakan satu dengan lainnya.
6. Naskah ini ditulis dalam bahasa Inggris yang tidak baik alias bahasa Indonesia yang di-Inggris-kan. Hal ini sangat menyulitkan *reviewer* (mitra bestari) untuk mengerti apa yang mau disampaikan oleh penulis. Sedapat mungkin kalimat2 berbahasa Inggris yang membingungkan telah diperbaiki oleh *reviewer*, tetapi ada paragraf yang benar2 hampir tidak dapat dipahami. Oleh sebab itu paragraf2 tersebut harus ditulis kembali dengan bahasa Inggris yang baik dan benar.
7. Semua perbaikan, komentar dan saran dituliskan langsung dalam naskah dengan menggunakan facilitas Review (Comments dan Track Changes).

Bersama ini saya kirimkan naskah yang telah saya review beserta formulir yang telah saya lengkapi.
Pada dasarnya naskah ini baik dan layak diterbitkan terutama hasilnya dapat digunakan untuk mengelola rawa banjiran Lubuk Lampam, tetapi memerlukan perbaikan yang sangat besar. Ada 2 masalah utama yang perlu diperhatikan dan diperbaiki oleh penulis:1. Pembahasan tulisan kurang mendalam sehingga data-data unik dari Lubuk Lampam kurang ditonjolkan.2. Naskah ini ditulis dalam bahasa Inggris yang buruk sehingga menyulitkan reviewer untuk mengerti apa yang hendak disampaikan oleh penulis. Oleh sebab itu diperlukan waktu yang panjang untuk mencerna naskah ini. Karena banyaknya perbaikan, baik bahasa Inggris-nya, komentar dan kesalahan ketik maka semua perbaikan, komentar dan saran dituliskan langsung pada naskah dengan menggunakan fasilitas Review pada Word. Tidak mungkin kesemuanya ini ditulis pada lembar terpisah seperti tertulis pada lembar formulir. Catatan: nama reviewer pada naskah yang telah di'review' telah dihilangkan.

REFEREE’S REPORT

Reference Number : SS14-048

Title : Trophic State of Floodplain River Lubuk Lampam South Sumatera Indonesia

Instructions for Referees

Please provide an overall assessment of the paper and provide answers to the following questions. Detailed comments and recommendations should not be written in the text, but should be numerically listed on separate sheets of paper that do not reveal your identity or affiliation. Minor wording or grammatical changes can be indicated in red pen or pencil in the text.

I. Please give your *appreciation of the scientific interest and novelty* of results described
(in Indonesia or in English)

.....

.....

J. Style and Organization (Please check as appropriate) **Double Click**

13. Is it clearly presented, well organized, and clearly written? ☒ Yes ☐ No
14. Does it contain superfluous material? ☐ Yes ☒ No
15. Is the title appropriate? ☒ Yes ☐ No
16. Does the abstract include the important points of the paper ☐ Yes ☒ No
17. If applicable, is the experiment section sufficiently detailed? ☒ Yes ☐ No
18. Is sufficient information included or cited to support the assertions made and conclusions drawn? ☒ Yes ☐ No

23. Are references to related work adequate, up to date and readily available? ☒ Yes ☐ No
24. Are the illustrations and tables all necessary and adequate? ☒ Yes ☐ No
25. Are the figure and table captions complete and accurate? ☒ Yes ☐ No
26. Are the conclusions satisfactory, sound and justified ☒ Yes ☐ No
27. Do you agree with the "Prime Novelty" as indicated (by the author)? ☐ Yes ☐ No
    Why or why not? Not yet……
    ……
28. Does the manuscript contain original and self-consistent ideas? ☒ Yes ☐ No
    Please comment ……
    ……
29. Does the manuscript contain subject matter that might/should be omitted? ☐ Yes ☒ No
    If so, what? ……
    ……
30. For manuscript in English, Is the English satisfactory? ☐ Yes ☒ No

K. Quality and Assessment
(Please check as appropriate)

- ☐ Makes major contributions to the advancement of the subject
- ☒ Sound, original, and of interest
- ☐ Sound, original, but not suitable for Makara Seri Sains
- ☐ Does not add to knowledge of the subject
- ☐ Contains fundamental errors or faulty judgements

L. Referee's Recommendation
(Please check all boxes that apply)

- ☐ Acceptable in present form
- ☐ Acceptable with grammatical revision
- ☒ Acceptable with minor technical revision
- ☐ Acceptable with major technical revision
- ☐ Submit to further refereeing :

(Suggest name of referee) .....

- ☐ Reject

Check here if you want to see the Revised Version ☐

Check here if you made annotation on the manuscript ☐

E. Timeliness of Research	☐ New	☒ Somewhat New	☐ Old
F. Scientific Impact	☐ High	☒ Moderate	☐ No Impact
G. Match between title, abstract, data and conclusions	☐ Excellent	☐ Good	☒ Poor
H. Rate scientific novelty to the community	☐ High	☒ Medium	☐ Low
I. Rate the interest to the community	☐ High	☒ Medium	☐ Low

J. Remarks/Additonal Comments (if any)

(in Indonesia or in English)

A lot of mistakes in using tenses, between past to present and vice versa. Abstract did not contain numbers/result that showed the fact.

Trophic State of Floodplain River, Lubuk Lampam South Sumatera Indonesia

Abstract

Trophic state of Lubuk Lampam floodplain river was affected by natural change of water level fluctuation. The ecosystem also receives substantial load of nutrient and other chemical resulting from the anthropogenic activities, especially from oil palm plantation and it's industrial processing. The main objective of this research was to determine trophic state of the floodplain river area using Carlson's trophic state index (TSI) and trophic level index (TLI). The water quality and fish samples were collected and analysed from 7 stations that representing types of habitat of the floodplain. The results show that based on the two methods, the trophic state of Lubuk Lampam were hypereutrophic. This trophic status was supported by the substantial additional weight and gonado somatic index (GSI) of fish sampel.

Key words : floodplain rivers, trophic state, Lubuk Lampam

Abstrak

Status Trofik Rawa Banjiran Lubuk Lampam, Sumatera Selatan. Rawa banjiran Lubuk Lampam merupakan ekosistem yang secara alamiah dipengaruhi oleh perubahan muka air. Ekosistem ini juga menerima bahan masukan antropogenik berupa nutrien dan bahan kimia pertanian terutama dari perkebunan kelapa sawit dan industri pengolahannya. Penelitian ini bertujuan untuk menentukan status trofik untuk rawa banjian menggunakan *Trophic State Index* (TSI) dari Carlson dan *Trophic Level Index* (TLI). Pengambilan dan analisis contoh air dan ikan pada 7 stasiun contoh yang mewakili tipe habitat rawa banjiran. Berdasarkan dua formula indeks tersebut diperoleh hasil yang menunjukkan bahwa Lubuk Lampam berada dalam status hypereutrofik (sangat subur). Indikasi kesuburan juga ditunjukkan dengan pertambahan berat ikan yang tinggi dan indeks kematangan gonad ikan (*Gonado Somatic Index*, GSI) yang cukup besar.

Kata Kunci : Rawa banjiran, status trofik, Lubuk Lampam

1. Introduction

There are variety of methods used in assessing the trophic state of water bodies, on ranging from single to multi parameters [1-7]. The most classical and commonly used was introduced by Carlson [7-16], i.e. the trophic state index (TSI) in which the calculation is built by total phosphorus, chlorophyll-a, and water transparency. Later, the TSI index has been modified by adding total N into calculation [16-20]. In the next development, estimation on aquatic trophic state was improved by the trophic level index (TLI). This index is applied by adding the value of total P to the previous index [21-22]. .

Both Carlson's TSI and TLI are applicable in determining the trophic status on stagnant waters including lakes and reservoirs. However, Carlson [7] stated that TSI was also appropriate to be used in flowing waters including streams and riverine habitats. Some studies shown the applicability of TSI in dynamic waters (23-24).

In comparison with lakes and rivers, water body in the floodplain habitats are characterized by both lotic and lentic components [25]. The oscillation between terrestial and aquatic phase resulted from rise and drop of water level. Therefore, the areas are periodically inundated by the lateral overflow of rivers [26].

Since flooding originates from three sources i.e. overspill from the river channels, local rainfall and tides, the changing of these sources will cause the changing of floodplain water qualities and later will influence the trophic status of the floodplain. According to Welcomme [25], the great fluctuation in water level cause a seasonal (mean?) seasonal? cycle of flood and drought over much of the area. Extreme changes in water chemistry and primary production also occur throughout the cycle. The trophic status determination of floodplain is important because the indexes can be used as a predictive tool in effective water management programs [7, 20].

Lubuk Lampam is one of important floodplain area situated in district of Ogan Komering Ilir. The main river of the area is Lempuing river, one of Komering River tributaries. This area is one of natural floodplain that is important for ecological balance. Meanwhile, this area also important for local economic growth especially from fisheries and agricultural activities [27]. The government has determined several sites within the area as fisheries reserves, i.e. Lebung Proyek, Suak Buayo, and Kapak Hulu as shown in Figure 1. The potential threat to this floodplain is identified from the landscape changes such as deforestation and land clearance for agriculture i.e. oil palm plantation and industrial processing. Those activities are influenced the water quality deriving from leaching of pesticide, fertilizer and other agrochemicals [28].

There is limited information about trophic state on Lubuk Lampam Floodplain (LLF). This study, therefore, is aimed to asses the trophic status of this floodplain in relation with water level fluctuation and anthropogenic substances mainly from oil palm plantation and its industrial processing.

2. Materials and Methods

Seven sampling sites were set up located in the upstream, inside and downstream of LLF (Fig. 1), i.e. 1) upper course main river Kapak Hulu (KH), 2) flooded grassland LK1, 3) natural floodplain pools Suak Buayo (SB), 4) man-made floodplain pools Lebung Proyek (LP), 5) channels of oil palm plantation (CP), 6) Flooded grassland LK2, 7) downstream Lempuing Hilir (LH). Sampling was done monthly at all sites but in the flooded grassland (LK1 and LK2) were took place only during flood season.

Sampling were conducted from December 2012 to November 2013, covering water quality (the whole period with monthly interval), the anthropogenic substances (detergent, herbicide, oil and grease; these parameters were taken only during flooding, highest water level, and dry season period). Water samples were collected, preserved, kept cooled at 4^{o}C, and analysed based on standard methods [29]. Measurement on total nitrogen (TN) and total phosphorus (TP) were performed using spectrophotometric analyser. Chlorophyll-a (Chl-a) was collected, preserved with $MgCO_3$ and determined using spectrophotometric methods. Oil and grease was analysed using gravimetric methods, detergent was analysed using spectrophotometric analyser, and herbicide using gas chromatography.

TN:TP criteria are classified into three categories : nitrogen limited (TN/TP < 10:1), phosphorus limited (TN/TP > 30:1), and balanced (10:1≤ TN/TP ≥30:1) [17-18].

Trophic state of Lubuk Lampam is calculated by the Carlson's TSI value [7, 11, 30]. The TSI formula is:

$$TSI_{SD} = 10x[6-(\ln SD/\ln 2)] \quad (1)$$

$$TSI_{Chl\ a} = 10x[6-((2.04-0.68 \ln Chl\ a)/\ln 2)] \quad (2)$$

$TSI_{TP} = 10x[6-ln(48/TP)/ln2]$ (3)
$TSI = [TSI(P)+TSI(chl\ a)+TSI(SD)]/3$ (4)

Where, SD=secchi disk (m); Chl=chlorophyll-a (µg/L); P = Total Phosphorus (µg/L)

The modified TSI formula namely the Trophic Level Index (TLI) [31-33] is calculated by:

$TLI_{Chl-a} = 2.22+2.54log_{10}(Chl)$ (5)
$TLI_{SD}=5.10+2.60log_{10}(1/S-1/40)$ (6)
$TLI_{TP}=0.218+2.92log_{10}(TP)$ (7)
$TLI_{TN}=-3.61+3.10log_{10}(TN)$ (8)
$TLI = \Sigma(TLI_{Chl} + TLI_S + TLI_{TP} + TLI_{TN})/4$ (9)

TN = Total Nitrogen (µg/L). The classification values based on TLI showed in Table 1. Trophic state index both TSI and TLI analysed among stations and season. Difference Mean of TSI and TLI was tested by a t-test at the 0.05 significance level.

In this study, 3 species of fishes i.e. *Osteochillus hasselti* (n=805), *Helostoma temminckii* (n=793) and *Channa striata* (n=397) were caught in Lubuk Lampam during study. Sample taken by fixed gillnet (0.5. 0.75, 1.0, 1.5, 2.0, 2.5, 3.0- mm mesh size) and portable traps. Samples were measured of total length (TL) and total wet weight for each species.

The length of the fish was measured to the nearest 0.5 mm, and the weight to the nearest of 0.01 mg. The length-weight relationship, $W=aL^b$ was converted to logarithmic expression : log W = Log a + b log L. In this formula W is weight in gram and L is total lenght of fish in mm. The "a" and "b" parameters were determined according to the power regression model. The "b" value for each species was tested by a t-test at the 0.05 significance level to verify if it was significantly different from 3 [41-44]

Sex determination of fish was examined by macroscopic gonad morphology after dissection (45). Gonads were separated from fish body and weighed and subsequently preserved in Gilson solution. Seasonal change in gonad mass for both sexes was determined using the gonado-somatic index (GSI). GSI calculated as GSI (%) = 100 x (weight of gonad / weight of fish) [41, 46-47].

3. Results

Cluster analysis of water level generated a dendrogam as shown in Figure 2 grouping 12 month into four clusters. Water level values nearly the same in the beginning of low water level (LWL) and beginning of flooding, put both in one cluster. In fact, they were in two difference cluster. Therefore, there were actually five clusters as shown in Figure 2, i.e. Clusters I (December 2012, January 2013, March 2013) representing inundation periods, Cluster II (February 2013) representing a highest water level, Cluster III (April 2013) representing the beginning of low water level, Cluster IV (May 2013, June 2013, July 2013 and August 2013) representing low water level or dry season, and Cluster V (September 2013, October and November 2013) representing the beginning of next flooding season. This grouping, then, is used to compare seasonal trophic state index in floodplain area.

The ratio of TN : TP in all stations sampling for five cluster and two season shows in Table 2. The TN:TP values summarized for two season shows that flood season higher than dry season unless on contrary in the riverine system (KH and LH). Actual concentration value of both TN and TP were high (range of mean values 43.03-57.08 mg/L and 2.64-4.93 mg/L, respectively) (Table 3).

Trophic status of floodplain based on Carlson's TSI and TLI value in each cluster shown in Figure 3 and 4. The highest mean TSI and TLI values is in dry periods (cluster IV) (Figure 3 and 4). This pattern also found in seasonal Trophic status of floodplain based on Carlson's TSI and TLI value (Figure 5), that the mean values of TSI and TLI tend to higher in the dry season than in flood season. The TSI and TLI nutrients (TP and TN) were higher than TSI and TLI both secchi depth and chlorophyll-a (Figure 4-6). Based on the mean of TSI values among stations (Figure 5), the highest TSI values was on channels plantation (CP).

Based on two-tailed t-test results, there were no significant mean difference of TSI and TLI among clusters (t-value 1.07), among stations in clusters (t-value 2.16), and between seasons (t-value 1.92), but significant mean difference among stations in seasons (t-value 2.29).

This study results showed that the "b" value from LWR (Figure 8) show that "b" values of most of fish were more than 3 (Figure 6). Meanwhile the GSI of three species of fishes in Lubuk Lampam showed in Figure 7.

4. Discussion

High concentration of TN and TP in LLF due to high nutrient in this area. Result study from Venterink *et al*. [48] shows the importance of floodplain for nutrient retention mainly for Nitrogen and Phosphorus. It's caused high concentration of these two nutrients in floodplain area. Otherwise, ratio TN : TP some of stations were tend to phosphorus as limiting factors (TN:TP > 30) and several were balance (10:1≤ TN/TP ≥30:1).

Based on TSI and TLI all of clusters are on hyper-eutrophic status. The hyper-eutrophic status of Lubuk Lampam affected by both natural characteristis and anthropogenic substances. Naturally, floodplain rivers is high productivity ecosystem [49]. Develophment of oil palm plantations in recent years could be the sources of anthropogenic susbtances in Lubuk Lampam. According to Huibin [20], lake that was at eutrophic and hyper-eutrophic levels, mainly affected by natural condition and anthropogenic activities such as domestic sewage, industrial and non-point source pollution. Organic pollutants, fertilizer-born nutrients (mainly nitrogen and phosphorus) and heavy metals can reach water coarses (what do you mean)through direct discharge, leaching or with eroded soil particles [50].

Trophic state of floodplain affected by season. According to Junk and Bayley [51], floodplain are most productive during the dry season. It could be happen because in the dry season, trophic status which is greatly influenced by the optimal primary productivity that supported by optimal light intensity and avaibility of nutrient This explanation not finished yet, add more explanation here. Eventhough, Junk [26] stated that in many river floodplains, the input of fertile sediments and dissolved nutrients that be carried by flooding was the main caused of the high productivity in many floodplain rivers.

High TSI nutrients (TP and TN) affected by high concentration of these two nutrients. According to Richardson [18], a large proportion of phosphorus in freshwater occurs as organic phosphates and cellular constituents in the biota or is adsorbed to inorganic and dead particulate matter. Highly TP and TN in floodplain mainly composed by particulate form. It's shows from the comparing values between TP and orthophosphate as dissolved form, also between TN and dissolved nitrogen form i.e. nitrate and nitrite (Table 3). Noe and Hupp [52] stated that High TP and TN concentration caused by constituents entering the floodplain flowpath during flooding. The TP concentration of floodplain is large and it's caused mainly by particulate P fractionation. Meanwhile, high TN during flooding caused by the decreasing 6% of dissolved organic nitrogen (DON) and increasing 5% of particulate organic nitrogen (PON).

The area of channel plantation (CP) was the highest TSI values and this area also categorized highly polluted [27]. According to Dembkowski [53], runoff from agricultural fields may contain high concentration of phosphorus and nitrogen-based pesticides and fertilizers, contributing to eutrophication. This station has high concentration of nutrients i.e. phosphorus and nitrogen (Table 3) and also tend to contaminated by several anthropogenic subtances (Table 4). Eventhough the concentration of contaminants were less than results studies from several researchers and many environmental and public health regulatory authorities [54-63], unless oil and Grease consentration was above the permissible value (PV) (1 mg/L) from Indonesian Government Regulation No. 82/2001 [64]. The meaning of the statement here not clear.

In spite of the two-tailed t-test result showed that significant mean difference among stations in season, but considering to the clasification values criteria, all stations were in hyper-eutrophic state. Hence, we can use this two formulas eventhough Wu *et al.* [65] suggested to use TLI because simpler, faster and more accurate. On the other hand, several researchers [17-18] suggested to use TSI if TP as limiting factors, and use TLI if TN as limiting factors or nutrient balance.

Relationship between trophic state habitat and length-weight relationship (LWR) reported by Moutopoulos [66]. This study results showed that the "b" value from LWR were estimated for 3 species of fishes representing fishes floodplain group based on Welcomme [41] and also representing different food habit (*O. hassseltii* and *H. temmincki* tend to herbivore, whereas the *C. striata* is carnivora [25,67-68]. The "b" values of most of fish were more than 3 mean that the fish increase in weight as its grows and also showing the area offers good condition to these population [69-70]. The TSI values related to food availability for fish [63]. Abundant food supply and sufficient space area throughout the year were probably some of the main factors contributing to the steady increase in fish weight and length [42-70].

The GSI of fish as one of reproductive indicators also can be used to represent influence of trophic state (or Trophic state as mention in previous paraghraph) to reproductive pattern of fish. The high tropic state on cluster IV and V cause GSI

of three species of fishes also high. GSI of fish is higher in eutrophic water than oligotrophic, it's may be a result of greater nutrient availability [71].

5. Conclusions

Based on Carlson's TSI and TLI formula indicated that Lubuk Lampam is on the hypertrophic state. In the case of floodplain rivers, these two methods can be used. The high trophic status (or Trophic state as mention in previous paraghraph) of aquatic system gave positive effect to addition of weight and GSI of fish.

Acknowledgement

Financial support was received from scholarship of Directorate General of Higher Education, Ministry of Education and Culture, Indonesia. We are grateful to Laboratory of Fisheries, and also Laboratory of chemical, biological and productivity of soil, Faculty of Agriculture, Sriwijaya University; Laboratory of Productivity and Environmental; also Laboratory of Biology Department of Fisheries Resources Management, Bogor Agricultural University; Research Institute for Inland Water Fisheries; and Laboratory of Agrochemicals Residues, Environmental Research Institute, Ministry of Agriculture, Indonesia.

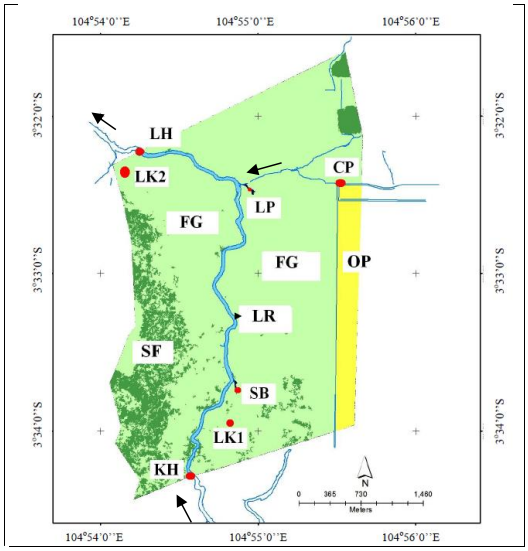
References

[1] Dodds, W.K. 2014. Eutrophication and trophic state in rivers and streams. (please re-check)Limol. Oceanogr. 51 (1.2): 671-680.
[2] Dodds, W.K. 2007. Trophic state, eutrophication and nutrient criteria in streams.Trends in Ecology and Evolution. 22 (12): 669-676 , www.sciencedirect.com. doi:10.1016/j.tree.2007.07.010.
[3] Hua, C.H., Ming, H.W., Asit, M., Yan, L. Trophic state, natural organic matter content, and disinfection by-product formation potential of six drinking water reservoirs in the Pearl River Delta, China. Journal of Hydrology. 359 : 164-173. www.elsevier.com/locate/jhydrol. doi:10.1016/j.jhydrol.2008.06.024.
[4] Carey, C.C and Rydin, E. 2011. Lake trophic status can be determined by the depth distribution of sediment phosphorus. Limnol. Oceanogr. 56(6) 2051–2063. doi:10.4319/lo.2011.56.6.2051
[5] Nawrocka, J and Kobos, J. 2011. The trophic state of the Vistula Lagoon : an assessment based on selected biotic and abiotic parameters according to the water framework directive. Oceanologia.53(3): 881-894. http://www.iopan.gda.pl/oceanologia/doi:10.5697/oc.53-3.881
[6] Schaedel, A. 2011. Oregon DEQ harmful algal bloom (HAB) strategy, Appendix D. DEQ State of Oregon Department of Environmental Quality. p.8.
[7] Carlson, R.E. 1977. A trophic state index for lakes. Limnology and Oceanography. 22 (2) : 361-369.
[8] Rakocevic-Nedovic, J and Hollert H. 2005. Phytoplankton community and chlorophyll *a* as trophic state indices of Lake Skadar (Montenegro, Balkan). Environ Sci & Pollut Res. 12(3)146–152. http://dx.doi.org/10.1065/espr2005.04.241
[9] Galvez-Cloutier, R and Sanchez, M. Trophic status evaluation for 154 Lakes in Quebec, Canada: monitoring and recommendations. Water Qual. Res. J. Canada. 42(4): 252-268.
[10] Murthi, G.P., Shivalingaiah, B.C., Leelaja, S.P., Hosmani. 2007. Trophic state index in conservation of lake ecosystems. Proceedings of Taal 2007 : The 12th World lake Conference. pp. 840-843.
[11] Elmaci, A., Ozengin, N., Teksoy, A., Topac, F.O., Baskaya, H.S. Evaluation of trophic state of lake Uluabat, Turkey. Journal of Environmental Biology. 30(5): 757-760. www. jeb.co.in.
[12] Molisani, M.M., de Sousa Barosso, H., Becker, H., Moreira, M.O.P., Hijo, C.A.G., de Monte, T.M., Vasconcellos, G.H. Trophic state, phytoplankton assemblages and limnological diagnosis of the Castanhão Reservoir, CE, Brazil. Acta Limnologica Brasiliensia. 22(1): 1-12. doi: 10.4322/actalb.02201001.
[13] Prasad, A.G.D and Siddaraju. 2012. Carlson's trophic state index for the assessment of trophic status of two Lakes in Mandya district. Advanced in Applied Science Research. 3(5): 2992-2996. www.pelagiaresearchlibrary.com.
[14] Rahmati, R., Pourgholam, R., Najafpour, S.H., Doudstdar, M. 2011. Trophic status of a Shallow Lake (North of Iran) based on the water quality and the phytoplankton community. World Applied Sciences Journal14 (special issue of food and environment).pp. 112-120
[15] Rahul, U., Arvind, P.K., Upadhyay, S.K. 2013. Assessment of lake water quality by using Palmer and Trophic State Index- a case study of Upper Lake, Bhopal, India. International Research Journal Environment Sciences. 2(5): 1-8. www.isca.in.

[16] Thomatou, A.A., Triantafyllidu, M., Chalkia, E., Kehayias, G., Konstantinou, I. Zacharias, I. 2013. Land use changes do not rapidly change the trophic state of a deep lake Amvrakia Lake, Greece. Journal of Environmental protection. 4: 426-434. http://www.scirp.org/journal/jep. doi:10.4236/jep.2013.45051.
[17] Sigua, G.C., Williams, M.J., Coleman, S.W., Starks, R. 2006. Nitrogen and phosphorus status of soils and trophic state of lakes associated with Forage-Based Beef Cattle operations in Florida. J. Environ. Qual. 35:240–252. doi:10.2134/jeq2005.0246
[18] Richardson, J. 2010. Water Quality Report for Selected Lakes and Streams. Leon County Public Works. Division of Engineering Services., 2010. p. 278
[19] Yaoyang, X., Meiling, S., Xinqin, H. Qinghua, C. 2010. Temporal asynchrony of trophic status between mainstream and tributary bay within a giant dendritic reservoir: the role of local-scale regulators. Water Air Soil Pollut. p.14. DOI 10.1007/s11270-010-0705-5.
[20] Huibin, Y., Beidou, X., Jinyuan, J., Heaphy, M.J., Hailong, W., Dinglong, L. 2011. Environmental heterogeneity analysis, assessment of trophic state and source identification in Chaohu Lake, China. China, Environ Sci Pollut Res. 18:1333-1342. DOI 10.1007/s11356-011-0490-8.
[21] Burns, N., Bryer, G., Bowman, E. 2000. Protocols for monitoring trophic levels of New Zealand lakes and reservoir. Ministry for the environmen, Wellington, New Zealand. p.130.
[22] Meredith, A and Wilks, T. Canterbury high country lakes water quality monitoring programme : results of the third year monitoring 2007. Environment Canterbury, 2007,p.39.
[23] Al-Abbawy D.A.H. 2012. Assesment of trophic status for Shatt Al-Arab river using trophic state index (TSI). Journal of Basrah Researches (Sciences). 38 (3.A): 36–44.
[24] Chaurasia, S., Dwivedi, R., Karan, R. 2013. Water quality and trophic status of the River Sai at Raibareli, Uttar Pradesh, India. Int. J. Curr. Sci. 9 : E 15-18. www.currentsciencejournal.info
[25] Welcomme, R.L. 1985. River Fishes. FAO Tech. Bull. 262, Rome. p.330.
[26] Junk, W.J. 1996. Perspectives in Tropical Limnology. In: Schiemer, F., Boland, K.T. (eds.), SPB Academic Publishing by Amsterdam, The Netherlands, 1996, p. 255.
[27] Jubaedah, D., Hariyadi, S., Muchsin, I., Kamal. M.M. 2014. Water Quality Index of Floodplain River Lubuk Lampam South Sumatera Indonesia. Proceeding of 4th International Conference on Environmental and Agriculture Engineering, Singapore.p.192
[28] Husnah. 2008. Potential Threat to the Floodplain Ecosystem of Lempuing River, South Sumatera. In: Hartoto, D.I., Koeshendrajana, S., Kartamihardja, E.S., Utomo, A.D., Nasution Z. (eds.),Fisheries Ecology and Management of Lubuk Lampam Floodplain Musi River, South Sumatera, Research Institute for Inland Water Fisheries, Ministry of Marine and Fisheries Affairs, Palembang. pp.149-155
[29] APHA. 1998.Standar methods for the examination of water and wastewater. 18th edition, APHA, AWWA and WPCF,
[30] Wenzhi, L., Quanfa, Z., Guihua, L. 2011. Effects of watershed land use and lake morphometry on the trophic state of Chinese lakes: implications for eutrophication control. Clean-soil, air, water. 39(1): 35-42. www.clean-journal.com. 10.1002/clen.201000052.
[31] Burns, N., McIntosh, J., Scholes, P. 2005. Strategies for managing the lakes of the Rotorua District, New Zealand. Lake and Reserv. Manage. 21(1) : 61-72
[32] Hamilton, D and Parparov, A. 2010. Comparative assessment of water quality with the Trophic Level Index and the Delphi Method in Lakes Rotoiti and Rotorua, NewZealand. Water Qual. Res. J. Can. 45(4): 479-489.
[33] Otago Regional Council. 2005. Lake Waipori and Lake Waihola : Trophic Level Status. Lake Waipori & Lake Waihola Trophic Level Status Report p.53.
[34] Castellano, S. 2013. A project Report in partial fulfillment of the requerements for the degree of Master of Sciences. Departement of Civil and Environmental Engineering, Brigham Young University.p.164
[35] Hughes, P.E. 1993. Water-Resources investigation report 91-4076.
[36] Welling, M.L., Munzenmaier, M., Waldmer, E., Bourne, J., Sutherland, S.R., Wardius, K., Magruder, C. 2001.Trophic State and Chlorophyll in the Milwauke, Wisconsin Harbor and surrounding nearshore waters. Water quality Reseach Departement Milwaukee Metropolitan Sewerage District. p 38.
[37] Sharma, M.P., Kumar, A., Rajvanshi, S. 2010. Assessment of Trophic State of Lakes: A Case of Mansi Ganga Lake in India. Hydro Nepal. 6:65-71.
[38] Fuller, L.M., Jodoin, R.S., Minnerick, R.J. 2011. U.S. Geological Survey Scientific Investigation Report 2011-5007.
[39] Chaves, F.I.B., Lima, P.F., Leitão, R.C., Paulino, W.D., Santaella, S.T. 2013. Influence of rainfall on the trophic status of a Brazilian semiarid reservoir. Acta Scientrum Biological Sciences, Maringá. 35(4): 505-511. http://www.uem.br/acta. Doi: 10.4025/actascibiolsci.v35i4.18261
[40] Santos, J.C.N., de Andeade, E.M., Neto, J.R.A., Meureles, A.C.M., Palacio HAQ. 2014. Land use and trophic state dynamics in a tropical semi-arid reservoir. Revista Ciência Agronômica. 45(1): 35-44. www.ccarevista.ufc.br.

[41] Welcomme, R.L. 1979. Fisheries Ecology of Floodplain Rivers, Longman Inc., New York. p.317.
[42] Montchowui, E., Kogbeto, M., Laleye, P. 2009. Weight–length relationships for commercial fish species caught in Lake Hlan in Benin (West Africa). Int. J. Biol. Chem. Sci. 3(3): 612-616. http://www.ajol.info.
[43] Gerami, M.H., Abdollahi, D., Patimar, R. 2013. Length-weight, length-length relationship and condition factor of *Garra rufa* in Cholvar River of Iran. World Journal of Fish and Marine Sciences. 5(4): 358-361. DOI: 10.5829/idosi.wjfms.2013.05.04.7371.
[44] Ezekiel, E.N. and Abowei, J.F.N. 2013. Length-Weight Relationship and Condition Factor of Heterotis niloticus from Amassoma flood plain, Niger Delta, Nigeria. Applied Science Report. 4(1): 164-172. www.pscipub.com/ASR.
[45] Effendie, M.I.. 1979. Metoda Biologi Perikanan, Yayasan Dewi Sri, Bogor.p.112.
[46] Effendie, M.I.. 1997. Biologi Perikanan, Yayasan Nusatama, Yogyakarta.p.163.
[47] Mondal, D.K. and Kaviraj, A. 2010. Feeding and reproductive biology of Indian Shad *Gudusia chapra* in two floodplain lakes of India. Electronic Journal of Biology. 6(4): 98-102.
[48] Venterink, H.O., Wiegmab, F., Van der lee, G.E.M., Vermaat, J.E. 2003. Role of avtive floodplains for nutrinet retention in the river Rhine. J. Environ. Qual. 32 : 1430-1435
[49] Graham, R and Harris, J.H. 2005. Floodplain inundation and fish dynamics in the Murray-Darling Basin. Current concepts and future research : a scoping study. CRC for Freshwater Ecology. p.56
[50] Lair, G.J., Zehetner, F., Fiebig, M., Gerzabek, M.H., Van Gestel, C.A.M., Hein, T., Hohensinner, S., Hsu, P., Jones, K.C., Jordan, G., Koelmans, A.A., Poot, A., Slijkerman, D.M.E., Totsche, K.U., Bondar-Kunze, E., Barth, J.A.C. 2009. How do long-term development and periodical changes of river–floodplain systems affect the fate of contaminants? Results from European rivers. Environmental Pollution. 157:3336-3346. www.elsevier.com/locate/envpol. doi:10.1016/j.envpol.2009.06.004.
[51] Junk, W.J. and Bayley, P.B. 2007. The Scope of the Flood Pulse Concept Regarding Riverine Fish and Fisheries, Given Geographic and Man-Made Differences between Systems. Proceeding of the American Society Syposiun 49, American Fisheries Society.p.587.
[52] Noe, G.B. and Hupp, C.R. 2007. Seasonal variation in nutrient retention during inundation of a short-hydroperiod floodplain. River Research and Applications. 23: 1088-1101. www.interscience.wiley.com. DOI: 10.1002/rra.1035.
[53] Dembkowski, D.J. 2011. Fish biodiversity in floodplain lakes of the Mississipi aluvial valey. Master Sciences Thesis, Faculty of Mississippi State University, United States. p.82
[54] Eisler, R. 1990. Paraquat Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. Biological Report. 85 (1.22). U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland.p.38.
[55] Adak, A., Pal, A., Bandyopadhyay, M. 2005. Spectrophotometric determination of anionic surfactants in wastewater using acridine orange. Indian Journal of Chemicl Technology. 12: 145-148
[56] WHO. 2005. Glyphosate and AMPA in drinking waters. http://www.who.int/water" sanitationhealth.p.19.
[57] Davis, A., Lewis, S., Bainbridge, Z., Brodie, J., Shannon, E. 2008. Pesticide residues in waterways of the lower Burdekin region : challenges in ecotoxicological interpretation of monitoring data. Australian Journal of Ecotoxicology. 14:89-108
[58] Singh, R.P., Ibrahim, M.H., Esa, N., Illiyana, M.S. 2010. Composting of waste from palm oil mill: a sustainable waste management practice. Rev. Environ. Sci. Biotechnol. 9: 331-344. DOI 10.1007/s11157-010-9199-2
[59] Ghoochani, M., Shekoohiyan, S., Mahvi, A.H., Haibati, B., Norouzi, M. 2011. Determination of Detergent in Tehran Ground and Surface Water. American-Eurasian Agric. & Environ. Sci. 10 (3) 464-469.
[60] Coupe, R.H., Kalkhoff, S.J., Capel, P.D., Gregorie, C. 2011. Fate and transport of glyphosate and aminomethylphosphonic acid in surface waters of agricultural basins. Pest. Manag. Sci. wileyonlinelibrary.com) DOI 10.1002/ps.2212.
[61] Shia, C., Yabu, M., Tran, K.V., Young, M.S. 2013. Improved resolution for paraquat and diquat : drinking water analysis using the CORTECS UPLC HLIC column. Waters, the sciences of what's posible. http://www.water.com. p.8.
[62] Kumar, R.T., Sampson, A., Dorathy, E., Wokoma, I., Ablorh, M.A. 2013. Study on environmentl impact on oil and gas activities in Ghana- Analysis by graphical approaches using Matlab. International Journal of Engineering Trends and Technology. 4(3): 344-348. http://www.internationaljournalssrg.org
[63] Oliver, D.P., Anderson, J.S., Davis, A., Lewis, S. Brodie, J., Kookana, R. 2014. Banded applications are highly effective in minimising herbicide migration from furrow-irrigated sugar cane. Science of the Total Environment. 466–467: 841–848 .www.elsevier.com/locate/scitotenv.
[64] Indonesia Goverment Regulation. 2001. Regarding Water Quality Management and Water Pollution Control, No. 82/2001.

[65] Wu, Z., Jie, R., Chen, S., Xin, Y., Liang, Y. 2012. Spatial-Time Comparative Analysis and Evaluation of Eutrophication Level of Nansi Lake. Asia Pacific Conference on Environmental Science and Technology, Advances in Biomedical Engineering. 6: 485-491.
[66] Moutopoulos, D.K., Koukou, K., Vavarouta, V., Ramfos, A., Katselis, G. 2011. Investigation of Length-Weight Relationships for 10 commercial fish species as a possible trophic state index of Coastal Lagoons. ACTA ADRIAT. 52(2): 261 – 268.
[67] Buchar, T., Handayani, T., Najamuddin, A. 2007. Ichtio-fauna danau Batu, Kalimantan Tengah. Journal of Tropical Fisheries. 2 (2): 188-200.
[68] Swingle, H.S and Allison, R. 1971. The inland fisheries progress 1970, Project report : AID/csd-2770, USOM/Thailand PIOT 493-180-3-80413, International Center for Aquaculture Auburn University, Auburn, Alabama,
[69] Akombo, P.M., Akange, E.T., Adikwu, I.A., Araoye, P.A. 2014. Length-weight relationship, condition factor and feeding habits of *Synodontis schall* (Bloch and Schneider, 1801) In river Benue at Makurdi, Nigeria. International Journal of Fisheries and Aquatic Studies. 1(3): 42-48. www.fisheriesjournal.com.
[70] Ikongbeh, O.A., Ogbe, F.G., Solomon, G. 2012. Length-weight relationship and condition factor of *Bagrus docmac* from Lake Akata, Benue state, Nigeria. Journal of Animal&Plant Sciences. 15(3): 2267-2274. http://www.m.elewa.org/JAPS
[71] Writer, J.H., Barber, L.B., Brown, G.K., Taylor, H.E., Kiesling, R.L., Ferrey, M.L., Jahns, N.D. Bartel, S.E. 2010. Anthropogenic tracers, endocrine disrupting chemicals, and endocrine disruption in Minnesota lakes. Science of the Total Environment. 409:100-111. www.elsevier.com/locate/scitotenv. doi:10.1016/j.scitotenv.2010.07.018



Sampling station
Lempuing Rivers
Boundary
Direction of current flow

Map Source :
1. Digital map of Indonesia earth surface, scale 1: 50.000, 2010
2. Worldview, 2013
3. On screen digitation, 2013
4. Sampling, 2013

Figure 1. Study area and sampling sites : Kapak Hulu (KH), flooded grassland 1 (LK1), Suak Buayo (SB), Lebung Proyek (LP), channels of oil palm plantations (CP), flooded grassland 2 (LK2), and Lempuing Hilir (LH), Flooded grassland (FG), flooded forest (SF), Lempuing river (LR), and oil palm plantation (OP).

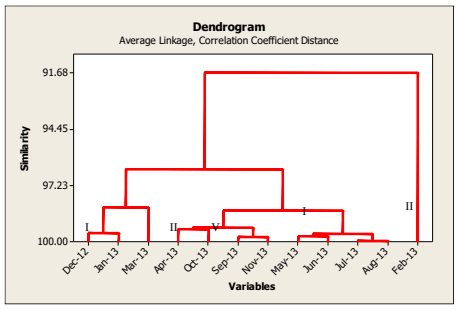


Figure 2. Cluster Analysis results of water Depth

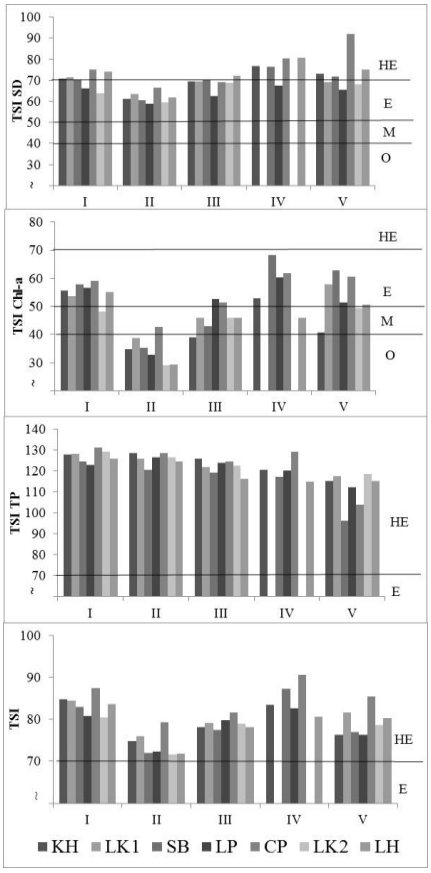


Figure 3. TSI values in each stations (KH, LK1, SB, LP, CP, L2, LH) and clusters (I, II, III, IV, V); HE (Hyper-eutrophic), E (Eutrophic), M (Mesotrophic), O (Oligotrophic)

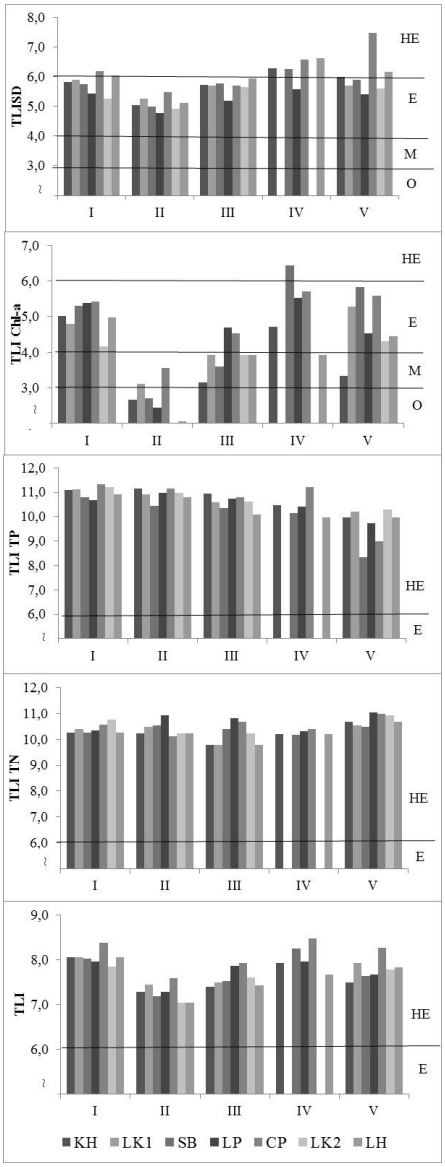


Figure 4. TLI values in each stations and clusters

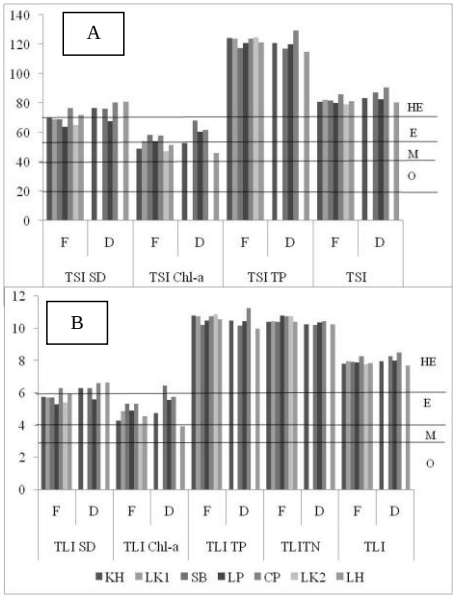


Figure 5. Seasonal values of TSI (A) and TLI (B), F (Flood season), D (Dry season)

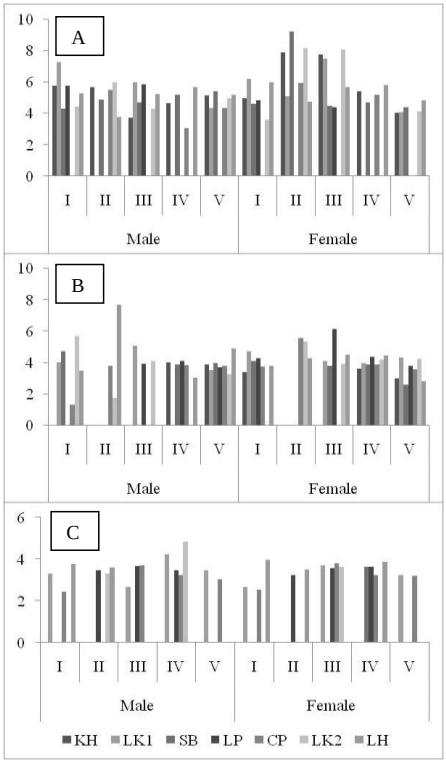


Figure 6. "b" values from fish lenght-weight relationship : (A) *O. hasselti,* (B) *H. temminckii,* and (C) *C. Striata,* Cluster (I, II, III, IV, and V)

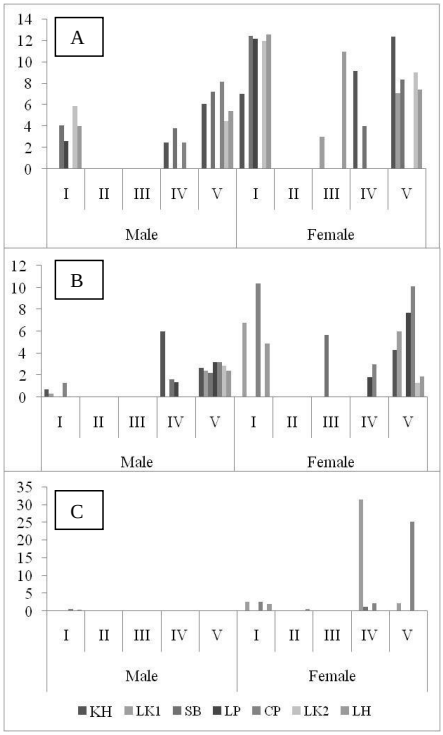


Figure 7. GSI : (A) *O. hasselti, (*B) *H. temminckii*, and (C) *C. Striata*, Cluster (I, II, III, IV, and V)

Table 1. TSI and TLI Classification values

Trophic state	TSI level*)	TLI level**)
Oligotrophic (O)	< 40	< 3.0
Mesotrophic (M)	40< TSI ≤50	3.0< TSI ≤4.0
Eutrophic (E)	50<TSI≤70	4.0<TSI≤6.0
Hyper-eutrophic (HE)	>70	>6.0

*) TSI Level adopted and modified from some references [6, 9, 17, 30, 34-40]
**) TLI level based on Castellano [34]

Table 2. Ratio TN : TP (mol)

Station	Cluster					Season	
	I	II	III	IV	V	Flood	Dry
KH	17	16	13	27	56	24	27
LK1	18	23	18	-	43	25	-
SB	21	35	34	33	176	38	33
LP	25	31	34	30	90	41	30
CP	18	14	30	17	155	32	17
LK2	22	18	24	-	58	30	-
LH	21	21	47	42	56	32	42

- : no observation at dry season

Table 3. Mean of concentration of TN, TP, nitrite, nitrate and orthophosphate (mg/L)

Station	TN	TP	Nitrite	Nitrate	Ortho-phosphate
KH	43.03	3.90	0.30	2.67	0.08
LK1	44.42	4.22	0.02	1.96	0.11
SB	46.88	2.64	0.25	3.07	0.07
LP	53.90	3.06	0.20	2.76	0.10
CP	53.12	**4.93**	**0.30**	**4.53**	**0.16**
LK2	**57.08**	4.41	0.02	1.70	0.07
LH	44.41	2.92	0.17	2.88	0.12

Bold characters are the highest value

Table 4. Antrophogenic substances concentration (mg/L)

Stations	oil and grease	Detergent	Glyphosate	Paraquat
KH	1.725	0.056	0.003	0.003
LK1	0.750	0.041	0.002	0.003
SB	2.500	0.061	0.003	0.003
LP	2.125	0.065	**0.005**	**0.011**
CP	**4.250**	**0.071**	0.002	0.004
LK2	0.500	0.028	0.001	0.002
LH	3.125	0.046	0.005	0.003

Bold characters are the highest value

Trophic Stateus of Lubuk Lampam Floodplain~~River~~, ~~Lubuk Lampam~~ South Sumatera, Indonesia

Commented [A1]: = rawa banjiran; jadi tidak perlu menambahkan kata "river"

Abstract

~~Trophic state of~~ Lubuk Lampam floodplain ecosystem ~~river wai~~s naturally affected by the ~~natural~~fluctuation ~~change~~ of the water surface~~level fluctuation~~. Th~~i~~se ecosystem also receives anthropogenic ~~substan~~substances~~tial load of~~such as nutrient and other chemicals~~resulting from the anthropogenic activities,~~ especially from oil palm plantation and it's industrial processing activities. The main objective of this research was to determine the trophic state~~e~~us of the floodplain ~~river area~~ using ~~Carlson's t~~TrophicS~~s~~tate~~i~~Index (TSI) of Carlson and ~~t~~Trophic~~l~~Level~~i~~Index (TLI). The water quality and the fish samples were collected and analyzed from 7 stations ~~that~~ representing various habitat types of ~~habitat of~~the floodplain. The results~~show that~~ based on the two methods show that~~,~~ the trophic state~~e~~us of LubukLampam w~~ere~~as hypereutrophic (very nutrient-rich). The~~is~~ fertility indication ~~trophic status~~ was also supported by the high increase of the body weight~~substantial additional weight~~ and the high gonado somatic index (GSI) of the studied fish~~es sampel~~.

Key words : floodplain ~~rivers~~, trophic statuse, Lubuk Lampam

Abstrak

Status Trofik Rawa Banjiran Lubuk Lampam, Sumatera Selatan. Rawa banjiran Lubuk Lampam merupakan ekosistem yang secara alamiah dipengaruhi oleh perubahan muka air. Ekosistem ini juga menerima bahan masukan antropogenik berupa nutrien dan bahan kimia pertanian terutama dari perkebunan kelapa sawit dan industri pengolahannya. Penelitian ini bertujuan untuk menentukan status trofik untuk rawa banjian menggunakan *Trophic State Index* (TSI) dari Carlson dan *Trophic Level Index* (TLI). Pengambilan dan analisis contoh air dan ikan pada 7 stasiun contoh yang mewakili berbagai tipe habitat rawa banjiran. Berdasarkan dua formula indeks tersebut diperoleh hasil yang menunjukkan bahwa Lubuk Lampam berada dalam status hypereutrofik (sangat subur). Indikasi kesuburan juga ditunjukkan dengan pertambahan berat ikan yang tinggi dan indeks kematangan gonad ikan (*Gonado Somatic Index*, GSI) yang cukup besar.

Kata Kunci : Rawa banjiran, status trofik, Lubuk Lampam

6. Introduction

There are ~~variety of~~ many methods used in assessing the trophic state of water bodies, ~~on~~ ranging from single to multi parameters [1-7]. The most classical and commonly used was introduced by Carlson [7-16], i.e. the trophic state index (TSI) in which the calculation is ~~built by~~ composed of total phosphorus, chlorophyll-a, and water transparency. Later, the TSI index ~~has been~~was modified by adding total Nitrogen into the calculation [16-20]. In the next development, the estimation o~~f~~n aquatic trophic state was improved by the trophic level index (TLI). This index is applied by adding the value of total P to the previous index [21-22].

Both Carlson's TSI and TLI are applicable in determining the trophic status on stagnant waters including lakes and reservoirs. However, Carlson [7] stated that TSI was also appropriate to be used ~~in~~for flowing waters including ~~streams~~and riverine~~habitats~~. Some studies showe~~d~~n the applicability of TSI in dynamic waters (23-24).

In comparison with lakes and rivers, water body in a~~the~~ floodplain ~~habitats are~~is characterized by both lotic and lentic components [25]. The oscillation between terrestial and aquatic phase resulted from rise and drop of water level. Therefore, the areas are periodically inundated by the lateral overflow of rivers [26].

Since flooding originates from three sources, i.e. overspill from the river channels, local rainfall and tides, the changing of these sources will cause the changing of the floodplain water qualities and later will ~~influence~~affect the trophic status of the floodplain. According to Welcomme [25], the great fluctuation in water level cause a seasonal cycle of flood and drought over much of the area. Extreme changes in water chemistry and primary production also occur throughout the cycle. The trophic status determination of floodplain is important because the indexes can be used as a predictive tool in effective water management programs [7, 20].

Lubuk Lampam is one of the important floodplain~~s~~area situated in ~~district of~~ Ogan Komering Ilir district. The main river ~~of~~in the~~is~~ area is Lempuing river, one of Komering River tributaries. This area is ~~one of~~a natural floodplain that is important for ecological balance. Meanwhile, this area is also important for local economic growth especially from fisheries and agricultural activities [27]. The goverment has determined several sites within the area ~~to be~~as fishery~~ies~~ reserves, ~~i.e.~~such as Lebung Proyek, Suak Buayo and Kapak Hulu as shown in Figure 1. The potential threat to this floodplain is ~~identified from~~ the land~~scape changes~~convertion, such as deforestation and land clearance for agriculture i.e. oil palm plantation and industrial processing. Those activities~~are influenced~~affect the water quality deriving from leaching of pesticide, fertilizer and other agrochemicals [28].

There is limited information about trophic state o~~nf~~ Lubuk Lampam Floodplain (LLF). This study, therefore, is aimed to ~~asses~~ reveal the trophic status of this floodplain in relation to~~with~~ water level fluctuation and anthropogenic substances mainly from oil palm plantation and its industrial processing.

7. Material~~s~~ and Methods

Seven sampling sites were set up ~~located~~ in the upstream, inside and downstream of LLF (Fig. 1), i.e. 1) upper course main river Kapak Hulu (KH), 2) flooded grassland LK1, 3) natural floodplain pools Suak Buayo (SB), 4) man-made floodplain pools Lebung Proyek (LP), 5) channels of oil palm plantation (CP), 6) flooded grassland LK2, 7) downstream Lempuing Hilir (LH). Sampling was done monthly at all sites ~~but in~~ except for the flooded grassland (LK1 and LK2) ~~were took place~~ only during the flood season.

Fish S~~s~~ampling and water quality checking were conducted from December 2012 to November 2013 ~~covering water quality (the whole period with monthly interval)~~, while the antrophogenic substances (detergent, herbicide, and oil and grease~~) were sampled~~ ~~these parameters were taken~~ only during the flood~~ing~~, highest water level, and dry season ~~period)~~. The W~~w~~ater samples were collected, preserved, kept cooled at 4˚C, and analy~~s~~zed based on standard methods [29]. Measurement on total nitrogen (TN) and total phosphorus (TP) were performed by using spectrophotometric analy~~s~~zer. Chlorophyll-a (Chl-a) was collected, preserved with $MgCO_3$ and determined using spectrophotometric method~~s~~. Oil and grease was analy~~s~~zed using gravimetric method~~s~~, detergent was analy~~s~~zed using spektrophotometric analyzer, and herbicide using gas chromatography.

TN:TP criteria are classified into three categories : nitrogen limited (TN/TP < 10:1), phosphorus limited (TN/TP > 30:1), and balanced (10:1≤ TN/TP ≥30:1) [17-18].

Commented [A2]: Apa pernyataan ini tidak salah? Unsur Nitrogen baru ditambah pada penghitungan TLI (lihat rumus pada Material and Method)

Commented [A3]: Stream dan river sudah termasuk dalam pengartian riverine; jadi pengulangan ungkapan tidak boleh dipakai lagi (=redundant)

Commented [A4]: Tidak ada bentuk jamak

Commented [A5]: Tidak perlu karena sudah diterangkan di atas bahwa sampling dilakukan setiap bulan

Trophic state of Lubuk Lampam wais calculated by using the Carlson's TSI value [7, 11, 30]. The TSI formula is:

$TSI_{SD} = 10x[6-(ln\ SD/ln2)]$ (1)
$TSI_{Chl\ a} = 10x[6-((2.04-0.68\ lnChl\ a)/ln2)]$ (2)
$TSI_{TP} = 10x[6-ln(48/TP)/ln2]$ (3)
$TSI = [TSI\ (P)+TSI\ (chl\ a)+TSI\ (SD)]/3$ (4)

Where, SD=secchi disk (m); Chl-a=chlorophyll-a (µg/L); P = Total Phosphorus (µg/L)

The modified TSI formula namely the Trophic Level Index (TLI) [31-33] is calculated by:

$TLI_{Chl-a} = 2.22+2.54log_{10}(Chl)$ (5)
$TLI_{SD}=5.10+2.60log_{10}(1/S-1/40)$ (6)
$TLI_{TP}=0.218+2.92log_{10}(TP)$ (7)
$TLI_{TN}=-3.61+3.10log_{10}(TN)$ (8)
$TLI = \Sigma(TLI_{Chl-a} + TLI_{SD} + TLI_{TP} + TLI_{TN})/4$ (9)

Where, TN = Total Nitrogen (µg/L).

The classification values based on TSI and TLIare showned in Table 1.Trophic state index bBoth TSI and TLI were analyszed based on among stations and season. The DifferenceMmean of TSI and TLI was tested by a t-test at the 0.05 significance level.

In this study, 3 species of fishes i.e. *Osteochillus hasselti* (n=805), *Helostoma temminckii* (n=793) and *Channa striata* (n=397) were caught in Lubuk Lampam during study. The Ssamples weretaken collected by fixedusing gillnet (0.5. 0.75, 1.0, 1.5, 2.0, 2.5, 3.0- mm mesh size) and portable traps. Then the Ssamples were measured offor their total lenghtlength (TL) and total wet weight for each species.

The length of the fish was measured to the nearest 0.5 mm, and the weight to the nearest of 0.01 mg. The lenghtlength-weight relationship, $W=aL^b$ was converted to logarithmic expression: log W = Llog a + b log L. In this formula W is weight in gram and L is total lenghtlengthof fish in mm. The "a" and "b" parameters were determined according to the power regression model. The "b" value for each species was tested by a t-test at the0.05 significance level to verify if it was significantly different from 3 [41-44].

The Ssex determination of the fish samples was determined examined bythrough macroscopic gonad morphology examinationafter dissection (45). Later, the Ggonads were separated from fish body and weighed and subsequently preserved in Gilson solution. Seasonal changes in gonad mass for both sexes wasere determined by using the gonado somatic index (GSI). The GSI is calculated as GSI (%) = 100 x (weight of gonad / weight of fish) [41, 46-47].

8. Results

Cluster analysis of water level generated a dendrogam as shown in Figure 2 grouping the 12 months of research into four clusters. The Wwater level values were similar nearly the same inat the beginning of low water level (LWL) and at the beginning of flooding hence grouped them , put both into one cluster. In fact, they were in two difference cluster. Therefore, there were actually five clusters as shown in Figure 2, i.e. Clusters I (December 2012, January 2013, March 2013) representing inundation periods, Cluster II (February 2013) representing athe highest water level, Cluster III (April 2013) representing the beginning of low water level, Cluster IV (May 2013, June 2013, July 2013 and August 2013) representing the lowest water level or dry season, and Cluster V (September 2013, October and November 2013) representing the beginning of next flooding season. This grouping, then, is used to compare seasonal trophic state index in floodplain area.

The ratio ofTN : TP in all stations sampling stations for five clusters and two seasons are shownsin Table 2. Tthe TN:TP values during sumarized for two season shows that the flood season is higher than those of during the dry season unless on contrary in except for the riverine system (KH and LH). Actual concentration value of both TN and TP were high (range of mean values 43.03-57.08 mg/L and 2.64-4.93 mg/L, respectively) (lihat Table 3).

The Ttrophic status of Lubuk Lampam floodplain based on Carlson's TSI and TLI values in each cluster are shown in Figure 3 and 4. The highest mean of TSI and TLI values isare in dry periods (cluster IV) (Figure 3 and 4). This pattern was also found in seasonal periods Trophic status of floodplain based on Carlson's TSI and TLI value (Figure 5).;that the

Commented [A6]: Apa maksudnya? Diameter? Kedalaman? terangkan

Commented [A7]: Harus sesuai dengan judul Tabel 1

Commented [A8]: Justru penggunaan t-test untuk mengetahui ada-tidaknya perbedaan

Commented [A9]: Nama species yang valid adalah *vittatus* bukan *hasselti*

Commented [A10]: Setiap orang yang mengarti ikan dan perairan pasti tahu apa itu "gillnet" dan bagaimana cara menggunakannya – jadi, tidak perlu diterangkan lagi. Kalau gillnet-nya tidak fix, namanya bukan gillnet

Commented [A11]: Tidak perlu diterangkan lagi karena sudah jelas diterangkan pada awal kalimat

Commented [A12]: Tidak perlu diterangkan. Ini adalah naskah untuk diterbitkan pada jurnal ilmiah dan BUKAN panduan praktikum Biologi Perikanan

Commented [A13]: Terangkan hal ini pada "Material and Methods"

Commented [A14]: Pernyataan ini sangat membingungkan; pada kalimat ini dinyatakan ada 2 kluster, tetapi pada kalimat berikutnya dinyatakan ada 5 kluster, dan pada kalimat pertama dinyatakan ada 4 kluster. Pernyataan pada paragraf ini harus diperbaiki sehingga dapat dimengerti oleh pembaca dengan baik.

Commented [A15]: Tetapi Figure 2 menunjukkan bahwa kedalaman air pada Apr-13 dan Oct-13 adalah sama dan membentuk kluster III

Commented [A16]: Pada Figure 2 jelas terlihat kedalaman air pada Sep-13 dan Nov-13 adalah sama dan membentuk 1 kluster. Okt-13 sangat jelas terpisah dari kluster V

Commented [A17]: Untuk bulan atau musim apa? Karena TN:TP berbeda untuk setiap musim (lihat Tabel 1)

mean values of TSI and TLI tend to be higher in the dry season compare to ~~than in~~ flood season.The TSI and TLI for nutrients (TP and TN) were higher than TSI and TLI of ~~both~~ secchi depth and chlorophyll-a (Figure 4-6). Based on the mean of TSI values among stations (Figure 5), the highest TSI value~~s~~ was found ~~o~~in channels of oil palm plantation (CP).

Based on two-tailed t-test ~~results~~, there wa~~sere~~ no significant mean difference of TSI and TLI among the clusters (t-value 1.07), among the stations ~~in~~based on thecluster~~s~~ (t-value 2.16), and between the seasons (t-value 1.92), but significant mean difference was found amongthe stationsbased ~~i~~onthe season~~s~~ (t-value 2.29).

The results of ~~T~~this study ~~results~~ showed that the "b" value from LWR (Figure ~~8~~6) show that. The "b" values of most of the studied fish were more than 3 (Figure 6). Meanwhile the GSI of the three fish species of fishes in LubukLampam showed in Figure 7.

9. Discussion

The ~~H~~high concentration~~s~~ of TN and TP in LLF were due to high nutrient in this area. These results were concord with the ~~Result~~ study results ~~from~~of Venterink *et al*. [48] showing~~s~~ the importance of a floodplain ~~for~~ as a nutrient retention mainly for Nitrogen and Phosphorus. ~~It's caused high concentration of these two nutrients in floodplain area.~~~~Otherwise~~However, ~~ratio TN : TP~~ in some ~~of~~ stations the ratio of TN:TP were tend to be phosphorus as a limitting factor~~s~~(TN:TP > 30) and in several stations the ratio were balance (10:1≤ TN/TP ≥30:1).

Based on TSI and TLI, all ~~of~~clusters had ~~are on~~ hypereutrophic status. The hypereutrophic status of Lubuk Lampam were affected by ~~both~~ natural characteristi~~s~~c and anthropogenic substances. Naturally, floodplain ~~rivers~~ is a high productivity ecosystem[49]. The establishment ~~Development~~ of oil palm plantations in recent years could be the source~~s~~ of the anthropogenic susbtances in Lubuk Lampam. According to Huibin [20], lake that has~~was a~~t eutrophic and hypereutrophic ~~levels~~status ,are mainly affected by natural condition and anthropogenic activities such as domestic sewage, and industrial and non-point source pollution. Organic pollutants, fertilizer-born nutrients (mainly ~~n~~Nitrogen and ~~p~~Phosphorus) and heavy metals can reach water coarses through direct discharge, leaching or with eroded soil particles [50].

The ~~T~~trophic state of a floodplain is affected by season. According to Junk and Bayley [51], a floodplain ~~are~~is most productive during the dry season. It is possible ~~could be happen~~ because ~~in~~ during the dry seasonthe optimal primary productivity~~, trophic status which~~ is greatly influenced by the ~~optimal primary productivity that supported by~~ optimal light intensity and the avaibility of nutrient which in turn affect the trophic status. Eventhough, Junk [26] stated that ~~in many river floodplains,~~ the input of fertile sediments and dissolved nutrients ~~that be~~ carried by flood~~ing~~ was the main caused of the high productivity in many floodplain~~s rivers~~.

The ~~H~~highTSI~~nutrient~~value~~s~~ (TP and TN) are affected by high concentration of these two nutrients. According to Richardson [18], a large proportion of phosphorus in freshwater occurs as organic phosphates and cellular constituents in the biota or is adsorbed ~~to~~ as inorganic and dead particulate matter. High~~ly~~ concentration of TP and TN in floodplain are mainly composed by particulate form. It~~'s~~ shows from the composition~~aring~~ values between TP and orthophosphate as dissolved form, also between TN and dissolved nitrogen form i.e. nitrate and nitrite (Table 3). Noe and Hupp [52] stated that the~~H~~high TP and TN concentration caused by the enteringconstituents~~entering~~ to the floodplain through flowpath during the flood~~ing~~. The TP concentration of a floodplain is ~~large~~ high and it~~'s~~ is caused mainly by particulate P fraction~~ation~~. Meanwhile, high TN concentration during flood~~ing~~ is caused by the decreasing 6% of dissolved organic nitrogen (DON) and increasing 5% of particulate organic nitrogen (PON).

The ~~area of~~ channel plantation (CP) ~~wh~~a~~s~~d the highest TSI values and this area was alsocategorized as highly polluted [27]. According to Dembkowski [53], runoff from agricultural fields may contain high concentration of phosphorus and nitrogen-based pesticides and fertilizers, contributing to eutrophication. This station ha~~s~~d high concentration of nutrients i.e. phosphorus and nitrogen (Table 3) and also tend to be contaminated by several anthropogenic sub~~s~~tances (Table 4). ~~Even~~ Although the concentration of the contaminants were less than the results ~~studies~~ from several researchstudies ~~researchers~~ and many environmental and public health regulati~~o~~n~~ry authorities~~ [54-63], ~~unless~~ however, oil and ~~G~~grease consentration was above the permissible value (PV,)i.e.(1 mg/L) from the Indonesian Government Regulation No. 82/2001 [64].

In spite of the two-tailed t-test result showed that significant mean difference among stations in season, but considering to the clasification values criteria, all stations were in hyper-eutrophic state.Hence, we can use thi~~e~~se two formulas.~~e~~Eventhough, Wu *etal*. [65] suggested to use TLI because it is simpler, faster and more accurate. On the other hand, several otherresearchers [17-18] suggested to use TSI if TP as the limit~~t~~ing factor~~s~~, and use TLI if TN as the limit~~t~~ing

Commented [A18]: Singkatan apa ini? terangkan

Commented [A19]: Ini bukan hasil. Berikan hasil pengukuran GSI dari ketiga jenis ikan yang dipelajari

Commented [A20]: Apa maksudnya? Cek kebenaran kata ini

Commented [A21]: Hasil penelitian [51] dan [26] harus dihubungkan dengan hasil penelitian penulis. Pembaca sama sekali tidak boleh memperkirakan sendiri maksud dari paragraf ini.

Commented [A22]: Bukankah TSI antara lain hanya dipengaruhi oleh TP, sedangkan TLI dipengaruhi oleh TP dan TN (lihat rumus TSI dan TLI). TSI dan TLI adalah indeks status suatu perairan, bukan 'nutrient'

Commented [A23]: Parameter apa yang diuji dengan t-test? Sebutkan. Perbaiki kalimatnya dengan bahasa Inggris yang benar. Kalimat ini sulit dipahami

factors or nutrient balance.

Relationship between trophic state habitat and length-weight relationship (LWR) was reported by Moutopoulos [66]. Thisresults of this study results showed that the "b" value from LWRwere estimated for the three 3 studied fish species of fishes representingfishes floodplain fishes group based onaccording to Welcomme [41].It and also representsing also different food habit of the studied fishes (*O. hassseltii* and *H. temmincki* tend to be herbivore, whereas theand*C. striata* is carnivorea [25,67-68]. The "b" values of most of fisheswereis more than 3 meaningthatthe fishes becomes weighter as its grows and also showing the area offers good condition to these population [69-70]. The TSI value is related to the foodavailability for the fish [63]. Abundant food supply and sufficient space area throughout the year were probably some of the main factors contributing to the steady increase in fish weight and length[42-70].

The GSI of fish as one of reproductive indicators also can be used to represent influence of trophic state to reproductive pattern of fish. The high tropic state on cluster IV and V cause GSI of three species of fishes also high.GSI of fish is higher in eutrophic water than oligotrophic, it's may be a result of greater nutrient availability[71].

10. Conclusions

Based on Carlson's TSI and TLI formulaindicated that LubukLampam is on the hypertrophic state. In the case of floodplainrivers, these two methods can be usedfor estimating the trophic status. The high trophic status of the aquatic system gave positive effect to the increase addition of the body weight and the GSI of the studied fishes.

Acknowledgement

Financial support was received from scholarship ofthe Directorate General of Higher Education, Ministry of Education and Culture, Indonesia. We are grateful to Laboratory of Fisheries, and also Laboratory of cChemical, bBiological and pProductivity of sSoil, Faculty of Agriculture, Sriwijaya University; Laboratory of Productivity and Environmental, andalso Laboratory of Biology, Departement of Fisheries Resources Management, Bogor Agricultural University; Research Institute for Inland Water Fisheries; and Laboratory of Agrochemicals Residues, Environmental Research Institute, Ministry of Agriculture, Indonesia.

References

[1] Dodds, W.K. 2014. Eutrophication and trophic state in rivers and streams. Limol. Oceanogr. 51 (1.2): 671-680.

[2] Dodds, W.K. 2007. Trophic state, eutrophication and nutrient criteria in streams.Trends in Ecology and Evolution. 22 (12): 669-676, www.sciencedirect.com. doi:10.1016/j.tree.2007.07.010.

[3] Hua, C.H., Ming, H.W., Asit, M., Yan, L. Trophic state, natural organic matter content, and disinfection by-product formation potential of six drinking water reservoirs in the Pearl River Delta, China. Journal of Hydrology. 359 : 164-173. www.elsevier.com/locate/jhydrol. doi:10.1016/j.jhydrol.2008.06.024.

[4]Carey, C.C and Rydin, E. 2011. Lake trophic status can be determined by the depth distribution of sediment phosphorus. Limnol. Oceanogr. 56(6) 2051–2063. doi:10.4319/lo.2011.56.6.2051

[5]Nawrocka, J and Kobos, J. 2011. The trophic state of the Vistula Lagoon : an assessment based on selected biotic and abiotic parameters according to the water framework directive. Oceanologia.53(3): 881-894. http://www.iopan.gda.pl/oceanologia/doi:10.5697/oc.53-3.881

[6] Schaedel, A. 2011. Oregon DEQ harmful algal bloom (HAB) strategy, Appendix D. DEQ State of Oregon Department of Environmental Quality. p.8.

[7] Carlson, R.E. 1977. A trophic state index for lakes. Limnology and Oceanography. 22 (2) : 361-369.

[8] Rakocevic-Nedovic, J and Hollert, H. 2005. Phytoplankton community and chlorophyll *a* as trophic state indicesof Lake Skadar (Montenegro, Balkan).Environ Sci & Pollut Res. 12(3)146–152. http://dx.doi.org/10.1065/espr2005.04.241

[9] Galvez-Cloutier, R and Sanchez, M.Trophic status evaluation for 154 lakes in Quebec, Canada: monitoring and recommendations. Water Qual. Res. J. Canada. 42(4): 252-268.

[10]Murthi,G.P.,Shivalingaiah, B.C.,Leelaja, S.P.,Hosmani. 2007. Trophic state index in conservation of lake ecosystems. Proceedings of Taal 2007 : The 12th World lake Conference. pp. 840-843.

[11]Elmaci, A., Ozengin, N.,Teksoy, A., Topac, F.O.,Baskaya, H.S.Evaluation of trophic state of Lake Uluabat, Turkey. Journal of Environmental Biology. 30(5): 757-760. www. jeb.co.in.

Commented [A24]: Tropic state dalam hal ini adalah status perairan, bukan habitat

Commented [A25]: Nama ini sudah tidak berlaku lagi; gunakan nama yang "valid"

Commented [A26]: Buat kalimat berbahasa Inggris yang baik

Commented [A27]: Buat kalimat berbahasa Inggris yang baik

Commented [A28]: Diskusi mengenai GSI terlalu singkat dan tidak mendalam. Paragraf ini harus diulas kembali lebih mendalam dan dihubungkan dengan hasil penelitian, yaitu berdasarkan species, sex dan semua cluster.

Commented [A29]: Scholarship artinya sama dengan financial support; penggunaan kata2 yang artinya sama tidak boleh dilakukan di dalam 1 kalimat

Commented [A30]: 1. Penulisan "References" harus diperbaiki; lihat Author Guidlines untuk jurnal Makara. 2. Banyak salah ketik/ typo error

[12] Molisani, M.M., de Sousa Barosso, H., Becker, H., Moreira, M.O.P., Hijo, C.A.G., de Monte, T.M., Vasconcellos, G.H.Trophic state, phytoplankton assemblages and limnological diagnosis of the Castanhão Reservoir, CE, Brazil. Acta Limnologica Brasiliensia. 22(1): 1-12. doi: 10.4322/actalb.02201001.
[13] Prasad, A.G.D and Siddaraju. 2012. Carlson's trophic state index for the assessment of trophic status of two lakes in Mandya district. Advanced in Applied Science Research.3(5): 2992-2996. www.pelagiaresearchlibrary.com.
[14] Rahmati, R.,Pourgholam, R.,Najafpour, S.H.,Doudstdar, M. 2011. Trophic status of a shallow lake (north of Iran) based on the water quality and the phytoplankton community. World Applied Sciences Journal14 (special issue of food and environment).pp. 112-120.
[15]Rahul, U., Arvind, P.K., Upadhyay, S.K. 2013. Assessment of lake water quality by using Palmer and Trophic State Index- a case study of Upper Lake, Bhopal, India. International Research Journal Environment Sciences. 2(5): 1-8. www.isca.in.
[16] Thomatou, A.A.,Triantafyllidu, M., Chalkia, E., Kehayias, G., Konstantinou, I., Zacharias, I. 2013.Land use changes do not rapidly change the trophic state of a deep lake Amvrakia Lake, Greece. Journal of Environmental protection. 4: 426-434.http://www.scirp.org/journal/jep.doi:10.4236/jep.2013.45051.
[17] Sigua, G.C., Williams, M.J., Coleman, S.W., Starks, R. 2006. Nitrogen and phosphorus status of soils and trophic state of lakes associated with forage-based beef cattle operations in Florida.J. Environ. Qual. 35:240–252. doi:10.2134/jeq2005.0246
[18] Richardson, J. 2010. Water QualityReport for Selected Lakes and Streams. Leon County Public Works. Division of Engineering Services. 2010. p. 278
[19] Yaoyang, X., Meiling, S.,Xinqin, H., Qinghua, C. 2010. Temporal asynchrony of trophic statusbetween mainstream and tributary bay within a giantdendritic reservoir: the role of local-scale regulators. Water Air Soil Pollut. p.14.DOI 10.1007/s11270-010-0705-5.
[20] Huibin, Y.,Beidou, X., Jinyuan, J.,Heaphy, M.J.,Hailong, W.,Dinglong, L. 2011. Environmental heterogeneity analysis, assessment of trophicstate and source identification in Chaohu Lake, China. China, Environ SciPollut Res. 18:1333-1342. DOI 10.1007/s11356-011-0490-8.
[21]Burns, N.,Bryer, G., Bowman, E. 2000. Protocols for monitoring trophic levels of New Zealand lakes and reservoir. Ministry for the environmen, Wellington, New Zealand. p.130.
[22] Meredith, A and Wilks, T. Canterbury high country lakes water quality monitoring programme : results of the third year monitoring 2007. Environment Canterbury, 2007, p.39.
[23]Al-Abbawy D.A.H. 2012. Assesment of trophic status for Shatt Al-Arab river using trophic state index (TSI). Journal of Basrah Researches (Sciences). 38 (3.A): 36–44.
[24] Chaurasia, S., Dwivedi, R., Karan, R. 2013. Water quality and trophic status of the River Sai at Raibareli, Uttar Pradesh, India. Int. J. Curr. Sci. 9 : E 15-18. www.currentsciencejournal.info
[25] Welcomme, R.L. 1985. River Fishes. FAO Tech. Bull. 262, Rome. p.330.
[26] Junk, W.J. 1996. Perspectives in Tropical Limnology. In: Schiemer,F., Boland, K.T. (eds.), xxx. SPB Academic Publishing by Amsterdam, The Netherlands, 1996, p. 255.
[27]Jubaedah, D.,Hariyadi, S.,Muchsin, I., Kamal. M.M.2014. Water Quality Index of Floodplain River Lubuk Lampam South Sumatera Indonesia. Proceeding of 4th International Conference on Environmental and Agriculture Engineering, Singapore.p.192.
[28] Husnah. 2008. Potential threat to the floodplain ecosystem of Lempuing River, South Sumatera. In: Hartoto, D.I.,Koeshendrajana, S., Kartamihardja, E.S.,Utomo, A.D.,Nasution Z. (eds.),Fisheries Ecology and Management of Lubuk Lampam Floodplain Musi River, South Sumatera. Research Institute for Inland Water Fisheries, Ministry of Marine and Fisheries Affairs, Palembang.pp.149-155.
[29] APHA. 1998.Standard methods for the examination of water and wastewater. 18th edition, APHA, AWWA and WPCF.
[30] Wenzhi,L., Quanfa,Z.,Guihua,L. 2011. Effects of watershed land use and lakemorphometry on the trophic state of Chineselakes: implications for eutrophication control.Clean-soil, air, water. 39(1): 35-42. www.clean-journal.com. 10.1002/clen.201000052.
[31]Burns,N.,McIntosh,J., Scholes,P. 2005. Strategies for managing the lakes of the Rotorua District, New Zealand. Lake and Reserv. Manage. 21(1) : 61-72
[32]Hamilton,D and Parparov,A. 2010. Comparative assessment of water quality with the Trophic Level Index and the Delphi Method in Lakes Rotoiti and Rotorua, NewZealand. Water Qual. Res. J. Can. 45(4): 479-489.
[33]Otago Regional Council. 2005. Lake Waipori and LakeWaihola : Trophic Level Status. Lake Waipori & Lake Waihola Trophic Level Status Report. p.53.
[34]Castellano,S.2013. A project report in partial fulfillment of the requirements for the degree of Master of Sciences. Department of Civil and Environmental Engineering, Brigham Young University. p.164
[35]Hughes,P.E.1993. Water-Resources investigation report 91-4076.
[36]Welling, M.L., Munzenmaier,M., Waldmer,E., Bourne,J., Sutherland,S.R., Wardius,K., Magruder, C. 2001.Trophic

Commented [A31]: Lengkapi nama bukunya

Commented [A32]: Judulnya 2x?

State and Chlorophyll in the Milwauke, Wisconsin Harbor and surrounding nearshore waters. Water quality Reseach Department, Milwaukee Metropolitan Sewerage District. p38.
[37]Sharma,M.P.,Kumar,A., Rajvanshi,S. 2010. Assessment of trophic state of lakes: Acase of Mansi Ganga Lake in India. Hydro Nepal. 6:65-71.
[38] Fuller,L.M.,Jodoin,R.S.,Minnerick, R.J.2011.U.S. Geological Survey Scientific Investigation Report 2011-5007.
[39]Chaves,F.I.B.,Lima,P.F.,Leitão,R.C.,Paulino,W.D.,Santaella,S.T. 2013. Influence of rainfall on the trophic status of a Brazilian semi-aridreservoir. ActaScientrum Biological Sciences, Maringá. 35(4): 505-511. http://www.uem.br/acta. Doi: 10.4025/actascibiolsci.v35i4.18261
[40]Santos,J.C.N.,de Andeade,E.M.,Neto,J.R.A.,Meureles,A.C.M., Palacio, H.A.Q. 2014. Land use and trophic state dynamics in a tropical semi-arid reservoir .Revista Ciência Agronômica. 45(1): 35-44. www.ccarevista.ufc.br.
[41] Welcomme,R.L. 1979. Fisheries Ecology of Floodplain Rivers, Longman Inc., New York. p.317.
[42] Montchowui,E.,Kogbeto,M., Laleye,P. 2009. Weight–length relationships for commercial fish species caught in Lake Hlan in Benin (West Africa). Int. J. Biol. Chem. Sci. 3(3): 612-616. http://www.ajol.info.
[43]Gerami,M.H., Abdollahi,D., Patimar,R. 2013. Length-weight, length-length relationship and condition factor of *Garra rufa* in Cholvar River of Iran. World Journal of Fish and Marine Sciences. 5(4): 358-361.DOI: 10.5829/idosi.wjfms.2013.05.04.7371.
[44]Ezekiel,E.N. and Abowei,J.F.N. 2013.Length-weight relationship and condition factor of *Heterotis niloticus* from Amassoma flood plain, Niger Delta, Nigeria. Applied Science Report. 4(1): 164-172. www.pscipub.com/ASR.
[45] Effendie, M.I. 1979. Metoda Biologi Perikanan, Yayasan Dewi Sri, Bogor. p.112.
[46] Effendie,M.I. 1997. Biologi Perikanan, Yayasan Nusatama, Yogyakarta. p.163.
[47]Mondal, D.K. and Kaviraj,A. 2010. Feeding and reproductive biology of Indian Shad *Gudusia chapra* in two floodplain lakes of India. Electronic Journal of Biology. 6(4): 98-102.
[48]Venterink, H.O., Wiegmab, F., Van der lee, G.E.M., Vermaat, J.E. 2003. Role of active floodplains for nutrinet retention in the river Rhine. J. Environ. Qual. 32 : 1430-1435.
[49]Graham, R and Harris, J.H. 2005. Floodplain inundation and fish dynamics in the Murray-Darling Basin. Current concepts and future research : a scoping study. CRC for Freshwater Ecology. p.56.
[50]Lair,G.J., Zehetner, F., Fiebig, M., Gerzabek,M.H., Van Gestel,C.A.M., Hein, T., Hohensinner, S., Hsu, P., Jones, K.C., Jordan, G., Koelmans, A.A., Poot, A., Slijkerman,D.M.E., Totsche, K.U., Bondar-Kunze, E., Barth, J.A.C. 2009. How do long-term development and periodical changes of river–floodplain systems affect the fate of contaminants? Results from European rivers. Environmental Pollution. 157:3336-3346. www.elsevier.com/locate/envpol. doi:10.1016/j.envpol.2009.06.004.
[51]Junk,W.J. and Bayley, P.B. 2007. The Scope of the Flood Pulse Concept regarding Riverine Fish and Fisheries, given Geographic and Man-Made differences between Systems. Proceeding of the American Society Syposiun 49, American Fisheries Society.p.587.
[52]Noe,G.B. and Hupp,C.R. 2007. Seasonal variation in nutrient retention during inundation of a short-hydroperiod floodplain. River Research and Applications. 23: 1088-1101. www.interscience.wiley.com. DOI: 10.1002/rra.1035.
[53]Dembkowski, D.J. 2011. Fish biodiversity in floodplain lakes of the Mississipi aluvial valey. Master of Science Thesis, Faculty of, Mississippi State University, United States. p.82
[54] Eisler,R.1990. Paraquat hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. Biological Report. 85 (1.22). U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland.p.38.
[55] Adak,A., Pal,A.,Bandyopadhyay,M. 2005. Spectrophotometric determination of anionic surfactants in waste water using acridine orange. Indian Journal of Chemicl Technology. 12: 145-148.
[56] WHO. 2005. Glyphosate and AMPA in drinking waters. http://www.who.int/water" sanitationhealth.p.19.
[57] Davis,A., Lewis, S., Bainbridge,Z., Brodie,J., Shannon,E. 2008. Pesticide residues in waterways of the lower Burdekin region : challenges in ecotoxicological interpretation of monitoring data. Australian Journal of Ecotoxicology. 14:89-108
[58] Singh,R.P.,Ibrahim,M.H., Esa,N., Illiyana,M.S. 2010. Composting of waste from palm oil mill: a sustainable waste management practice. Rev. Environ. Sci. Biotechnol. 9: 331-344. DOI 10.1007/s11157-010-9199-2
[59]Ghoochani,M., Shekoohiyan,S., Mahvi,A.H., Haibati,B., Norouzi,M. 2011. Determination of detergent in Tehran ground and surface water. American-Eurasian Agric. & Environ. Sci. 10(3)464-469.
[60]Coupe,R.H., Kalkhoff,S.J., Capel,P.D.,Gregorie, C. 2011. Fate and transport of glyphosate and aminomethylphosphonic acid in surface waters of agricultural basins. Pest. Manag. Sci.wileyonlinelibrary.com) DOI 10.1002/ps.2212.
[61]Shia,C., Yabu,M., Tran,K.V., Young,M.S. 2013. Improved resolution for paraquat and diquat : drinking water analysis using the CORTECS UPLC HLIC column. Waters, the sciences of what's posible. http://www.water.com. p.8.
[62] Kumar, R.T., Sampson, A., Dorathy, E., Wokoma, I., Ablorh, M.A. 2013. Study on environmental impact on oil

Commented [A33]: Fakultas apa? lengkapi

Commented [A34]: Lengkapi penulisannya

346 and gas activities in Ghana- Analysis by graphical approaches using Matlab. International Journal of Engineering
347 Trends and Technology. 4(3): 344-348. http://www.internationaljournalssrg.org
348 [63] Oliver,D.P., Anderson,J.S., Davis, A., Lewis,S., Brodie,J., Kookana,R. 2014. Banded applications are highly
349 effective in minimising herbicide migration from furrow-irrigated sugar cane. Science of the Total Environment.
350 466–467: 841–848. www.elsevier.com/locate/scitotenv.
351 [64] Indonesia Government Regulation. 2001. Regarding Water Quality Management and Water Pollution Control, No.
352 82/2001.
353 [65]Wu, Z., Jie, R., Chen,S.,Xin, Y.,Liang,Y. 2012. Spatial-Time Comparative Analysis and Evaluation of
354 EutrophicationLevel of Nansi Lake. Asia Pacific Conference on Environmental Science and Technology,
355 Advances in Biomedical Engineering. 6: 485-491.
356 [66]Moutopoulos,D.K., Koukou,K.., Vavarouta,V.,Ramfos,A., Katselis,G. 2011. Investigation of length-weight
357 relationships for 10 commercial fish species as a possible trophic state index of coastal lagoons.ACTA ADRIAT.
358 52(2): 261 – 268.
359 [67]Buchar,T., Handayani,T., Najamuddin,A. 2007. Ichtio-fauna Danau Batu, Kalimantan Tengah. Journal of Tropical
360 Fisheries. 2 (2): 188-200.
361 [68]Swingle,H.S. andAllison,R. 1971. The inland fisheries progress 1970, Project report : AID/csd-2770,
362 USOM/Thailand PIOT 493-180-3-80413, International Center for Aquaculture Auburn University, Auburn,
363 Alabama,
364 [69] Akombo, P.M., Akange, E.T., Adikwu, I.A., Araoye, P.A. 2014. Length-weight relationship, condition factor and
365 feeding habits of *Synodontis schall* (Bloch and Schneider, 1801) in River Benue at Makurdi, Nigeria. International
366 Journal of Fisheries and Aquatic Studies. 1(3): 42-48. www.fisheriesjournal.com.
367 [70]Ikongbeh, O.A.,Ogbe,F.G., Solomon,G. 2012. Length-weight relationship and condition factorof *Bagrus docmac*
368 from Lake Akata, Benue state, Nigeria. Journal of Animal&Plant Sciences. 15(3):2267-2274.
369 http://www.m.elewa.org/JAPS
370 [71]Writer,J.H.,Barber,L.B., Brown,G.K.,Taylor,H.E., Kiesling,R.L., Ferrey, M.L.,Jahns,N.D., Bartel,S.E. 2010.
371 Anthropogenic tracers, endocrine disrupting chemicals, and endocrine disruption in Minnesota lakes. Science of
372 the Total Environment. 409:100-111. www.elsevi e r.com/locate/scitotenv. doi:10.1016/j.scitotenv.2010.07.018
373
374

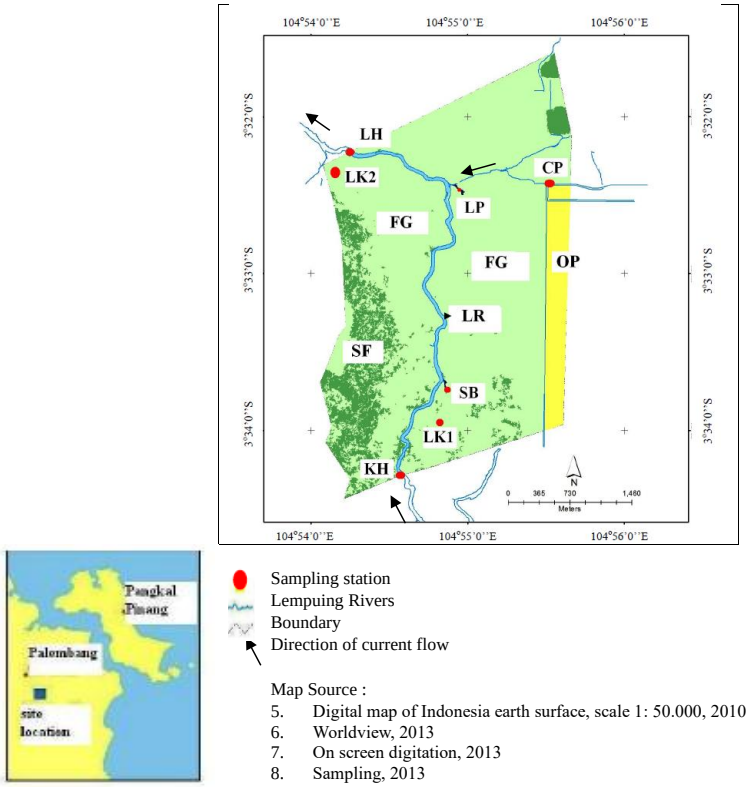


Figure 1. Study area and sampling sites : Kapak Hulu (KH), flooded grassland 1 (LK1), Suak Buayo (SB), Lebung Proyek (LP), channels of oil palm plantations (CP), flooded grassland 2 (LK2), and Lempuing Hilir (LH), Flooded grassland (FG), flooded forest (SF), Lempuing river (LR), and oil palm plantation (OP).

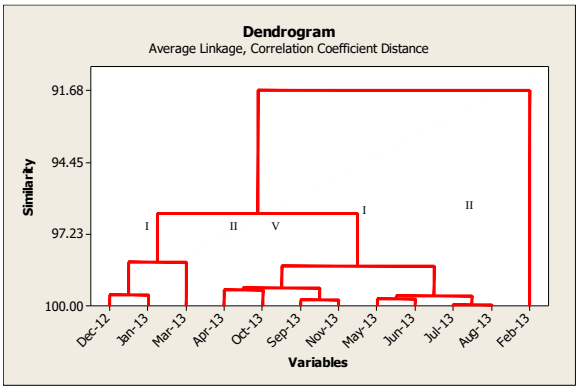


Figure 2. Cluster Analysis results of water depth

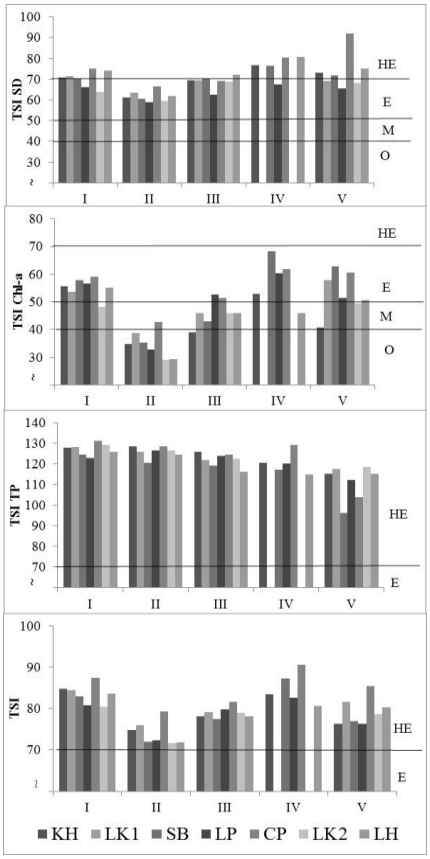


Figure 3. TSI values in each stations (KH, LK1, SB, LP, CP, L2, LH) and clusters (I, II, III, IV, V); HE (Hyper-eutrophic), E (Eutrophic), M (Mesotrophic), O (Oligotrophic)

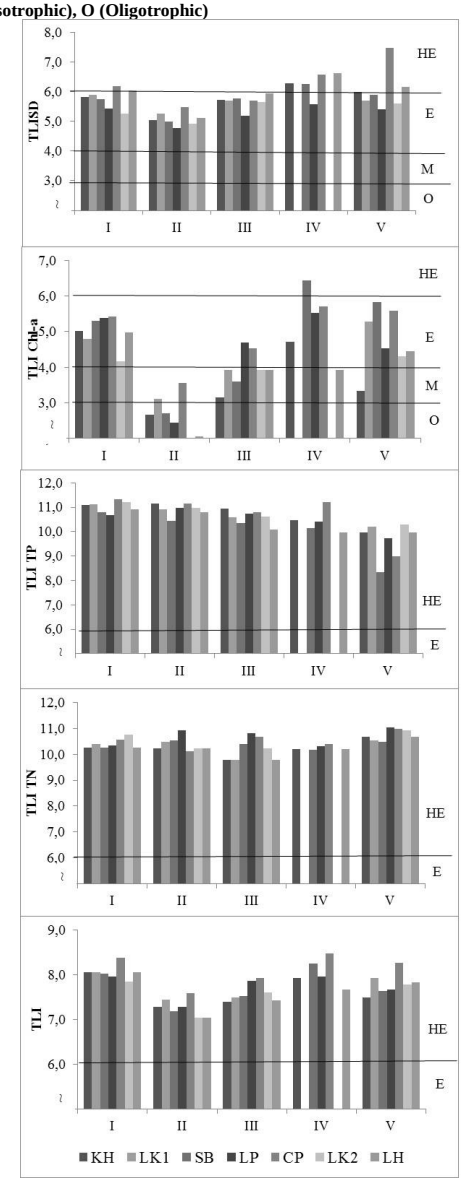


Figure 4. TLI values in each stations and clusters

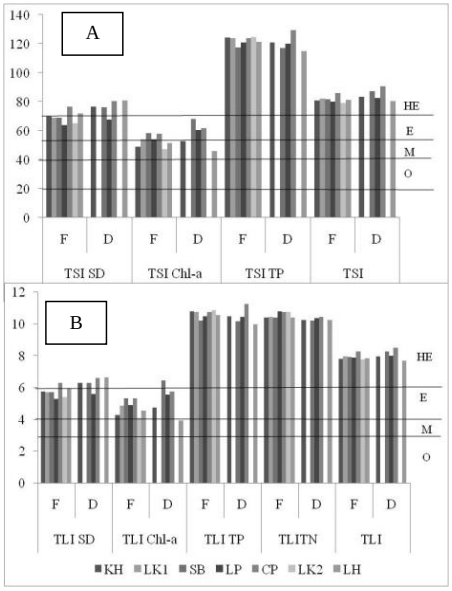


Figure 5. Seasonal values of TSI (A) and TLI (B), F (Flood season), D (Dry season)

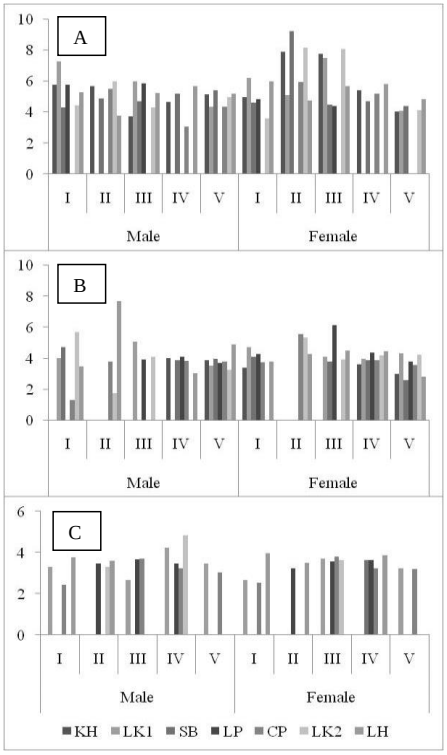


Figure 6. "b" values from fish lenght-weightrelationship : (A) *O. hasselti*, (B) *H. temminckii*, and (C) *C. Striata*, Cluster (I, II, III, IV, and V)

Commented [A35]: Ganti namanya

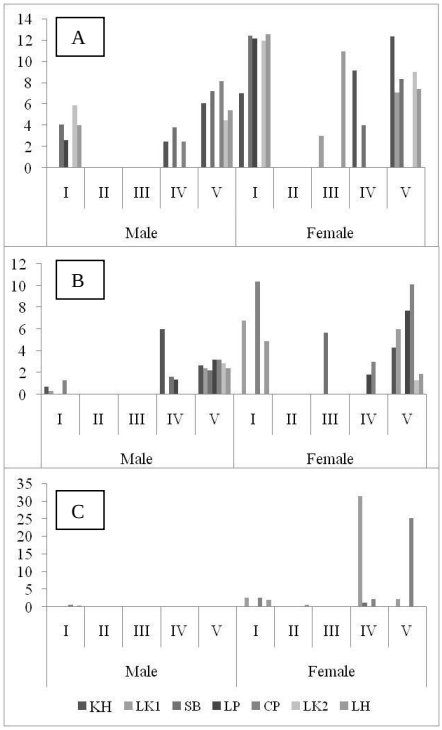


Figure 7. GSI : (A) *O. hasselti*, (B) *H.temminckii*, and (C) *C. Striata*, Cluster (I, II, III, IV, and V)

Commented [A36]: Ganti namanya

Table 1. TSI and TLI Classification values

Trophic state	TSI level*)	TLI level**)
Oligotrophic (O)	< 40	< 3.0
Mesotrophic (M)	40< TSI ≤50	3.0< TSI ≤4.0
Eutrophic (E)	50<TSI≤70	4.0<TSI≤6.0
Hyper-eutrophic (HE)	>70	>6.0

*) TSI Level adopted and modified from some references [6, 9, 17, 30, 34-40]
**) TLI level based on Castellano [34]

Table 2. Ratio TN : TP (mol)

Station	Cluster					Season	
	I	II	III	IV	V	Flood	Dry
KH	17	16	13	27	56	24	27
LK1	18	23	18	-	43	25	-
SB	21	35	34	33	176	38	33
LP	25	31	34	30	90	41	30
CP	18	14	30	17	155	32	17
LK2	22	18	24	-	58	30	-
LH	21	21	47	42	56	32	42

-: no observation at dry season

Table 3.Mean of concentration of TN, TP, nitrite, nitrate and orthophosphate (mg/L)

Station	TN	TP	Nitrite	Nitrate	Ortho-phosphate
KH	43.03	3.90	0.30	2.67	0.08
LK1	44.42	4.22	0.02	1.96	0.11
SB	46.88	2.64	0.25	3.07	0.07
LP	53.90	3.06	0.20	2.76	0.10
CP	53.12	**4.93**	**0.30**	**4.53**	**0.16**
LK2	**57.08**	4.41	0.02	1.70	0.07
LH	44.41	2.92	0.17	2.88	0.12

Bold characters are the highest value

Table 4. Antrophogenic substances concentration(mg/L)

Stations	oil and grease	Detergent	Glyphosate	Paraquat
KH	1.725	0.056	0.003	0.003
LK1	0.750	0.041	0.002	0.003
SB	2.500	0.061	0.003	0.003
LP	2.125	0.065	**0.005**	**0.011**
CP	**4.250**	**0.071**	0.002	0.004
LK2	0.500	0.028	0.001	0.002
LH	3.125	0.046	0.005	0.003

Bold characters are the highest value

Trophic State of Floodplain River, Lubuk Lampam South Sumatera Indonesia

Abstract

Trophic state of Lubuk Lampam floodplain river was affected by natural change of water level fluctuation. The ecosystem also receives substantial load of nutrient and other chemical resulting from the anthropogenic activities, especially from oil palm plantation and it's industrial processing. The main objective of this research was to determine trophic state of the floodplain river area using Carlson's trophic state index (TSI) and trophic level index (TLI). The water quality and fish samples were collected and analysed from 7 stations that representing types of habitat of the floodplain. The results show that based on the two methods, the trophic state of Lubuk Lampam were hypereutrophic. This trophic status was supported by the substantial additional weight and gonado somatic index (GSI) of fish sampel.

Key words : floodplain rivers, trophic state, Lubuk Lampam

Abstrak

Status Trofik Rawa Banjiran Lubuk Lampam, Sumatera Selatan. Rawa banjiran Lubuk Lampam merupakan ekosistem yang secara alamiah dipengaruhi oleh perubahan muka air. Ekosistem ini juga menerima bahan masukan antropogenik berupa nutrien dan bahan kimia pertanian terutama dari perkebunan kelapa sawit dan industri pengolahannya. Penelitian ini bertujuan untuk menentukan status trofik untuk rawa banjian menggunakan *Trophic State Index* (TSI) dari Carlson dan *Trophic Level Index* (TLI). Pengambilan dan analisis contoh air dan ikan pada 7 stasiun contoh yang mewakili tipe habitat rawa banjiran. Berdasarkan dua formula indeks tersebut diperoleh hasil yang menunjukkan bahwa status trofik di Lubuk Lampam adalah hypereutrofik (sangat subur). Indikasi kesuburan juga ditunjukkan dengan pertambahan berat ikan yang tinggi dan indeks kematangan gonad ikan (*Gonado Somatic Index*, GSI) yang cukup besar .

Kata Kunci : Rawa banjiran, status trofik, Lubuk Lampam

Commented [S37]: showed

Commented [S38]: those

Commented [S39]: hyper-eutrophic

Commented [S40]: samples

Commented [S41]: fluktuasi tingkat

Commented [S42]: kualitas air

Commented [S43]: hilangkan

Commented [S44]: Hasil menunjukkan bahwa berdasarkan dua metode tersebut

Commented [S45]: hilangkan

Commented [S46]: adanya

Commented [S47]: diganti nilainya

Commented [S48]: tambah angka

11. Introduction

There are variety of methods used in assessing the trophic state of water bodies, on ranging from single to multi parameters [1-7]. The most classical and commonly used was introduced by Carlson [7-16], i.e. the trophic state index (TSI) in which the calculation is built by total phosphorus, chlorophyll-a, and water transparency. Later, the TSI index has been modified by adding total N into calculation [16-20]. In the next development, estimation on aquatic trophic state was improved by the trophic level index (TLI). This index is applied by adding the value of total P to the previous index [21-22]. .

Both Carlson's TSI and TLI are applicable in determining the trophic status on stagnant waters including lakes and reservoirs. However, Carlson [7] stated that TSI was also appropriate to be used in flowing waters including streams and riverine habitats. Some studies shown the applicability of TSI in dynamic waters (23-24).

In comparison with lakes and rivers, water body in the floodplain habitats are characterized by both lotic and lentic components [25]. The oscillation between terrestial and aquatic phase resulted from rise and drop of water level. Therefore, the areas are periodically inundated by the lateral overflow of rivers [26].

Since flooding originates from three sources i.e. overspill from the river channels, local rainfall and tides, the changing of these sources will cause the changing of floodplain water qualities and later will influence the trophic status of the floodplain. According to Welcomme [25], the great fluctuation in water level cause a seasoal cycle of flood and drought over much of the area. Extreme changes in water chemistry and primary production also occur throughout the cycle. The trophic status determination of floodplain is important because the indexes can be used as a predictive tool in effective water management programs [7, 20].

Lubuk Lampam is one of important floodplain area situated in district of Ogan Komering Ilir. The main river of the area is Lempuing river, one of Komering River tributaries. This area is one of natural floodplain that is important for ecological balance. Meanwhile, this area also important for local economic growth especially from fisheries and agricultural activities [27]. The goverment has determined several sites within the area to be fisheries reserves, i.e. Lebung Proyek, Suak Buayo and Kapak Hulu as shown in Figure 1. The potential threat to this floodplain is identified from the landscape changes such as deforestation and land clearance for agriculture i.e. oil palm plantation and industrial processing. Those are influenced the water quality deriving from leaching of pesticide, fertilizer and other agrochemicals [28].

There is limitted information about trophic state on Lubuk Lampam Floodplain (LLF). This study, therefore, is aimed to asses the trophic status of this floodplain in relation with water level fluctuation and anthropogenic substances mainly from oil palm plantation and its industrial processing.

12. Materials and Methods

Seven sampling sites were set up located in the upstream, inside and downstream of LLF (Fig. 1), i.e. 1) upper course main river Kapak Hulu (KH), 2) flooded grassland LK1, 3) natural floodplain pools Suak Buayo (SB), 4) man-made floodplain pools Lebung Proyek (LP), 5) channels of oil palm plantation (CP), 6) Flooded grassland LK2, 7) downstream Lempuing Hilir (LH). Sampling was done monthly at all sites but in the flooded grassland (LK1 and LK2) were took place only during flood season.

Sampling were conducted from December 2012 to November 2013, covering water quality (the whole period with monthly interval), the antrophogenic substances (detergent, herbicide, oil and grease; these parameters were taken only during flooding, highest water level, and dry season period). Water samples were collected, preserved, kept cooled at 4^{o}C, and analysed based on standard methods [29]. Measurement on total nitrogen (TN) and total phosphorus (TP) were performed by using spectrophotometric analyser. Chlorophyll-a (Chl-a) was collected, preserved with $MgCO_3$ and determined using spectrophotometric methods. Oil and grease was analysed using gravimetric methods, detergent was analysed using spektrophotometric analyser, and herbicide using gas chromatography.

TN:TP criteria are classified into three categories : nitrogen limited (TN/TP < 10:1), phosphorus limited (TN/TP > 30:1), and balanced (10:1≤ TN/TP ≥30:1) [17-18].

Trophic state of Lubuk Lampam is calculated by the Carlson's TSI value [7, 11, 30]. The TSI formula is:

$$TSI_{SD} = 10x[6-(\ln SD/\ln 2)] \quad (1)$$

$$TSI_{Chl\ a} = 10x[6-((2.04-0.68 \ln Chl\ a)/\ln 2)] \quad (2)$$

Commented [S49]: varities of method

Commented [S50]: hapus

Commented [S51]: methods

Commented [S52]: later

Commented [S53]: show

Commented [S54]: floods originate

Commented [S55]: ,

Commented [S56]: fluctuation

Commented [S57]: large

Commented [S58]: areas

$TSI_{TP} = 10x[6-ln(48/TP)/ln2]$ (3)
$TSI = [TSI(P)+TSI(chl\ a)+TSI(SD)]/3$ (4)

Where, SD=secchi disk (m); Chl=chlorophyll-a (µg/L); P = Total Phosphorus (µg/L)

The modified TSI formula namely the Trophic Level Index (TLI) [31-33] is calculated by:

$TLI_{Chl-a} = 2.22+2.54log_{10}(Chl)$ (5)
$TLI_{SD}=5.10+2.60log_{10}(1/S-1/40)$ (6)
$TLI_{TP}=0.218+2.92log_{10}(TP)$ (7)
$TLI_{TN}=-3.61+3.10log_{10}(TN)$ (8)
$TLI = \Sigma(TLI_{Chl} + TLI_S + TLI_{TP} + TLI_{TN})/4$ (9)

TN = Total Nitrogen (µg/L). The classification values based on TLI showed in Table 1. Trophic state index both TSI and TLI analysed among stations and season. Difference Mean of TSI and TLI was tested by a t-test at the 0.05 significance level.

In this study, 3 species of fishes i.e. *Osteochillus hasselti* (n=805), *Helostoma temminckii* (n=793) and *Channa striata* (n=397) were caught in Lubuk Lampam during study. Sample taken by fixed gillnet (0.5. 0.75, 1.0, 1.5, 2.0, 2.5, 3.0 - mm mesh size) and portable traps. Samples were measured of total lenght (TL) and total wet weight for each species.

The length of the fish was measured to the nearest 0.5 mm, and the weight to the nearest of 0.01 mg. The lenght-weight relationship, $W=aL^b$ was converted to logarithmic expression : log W = Log a + b log L. In this formula W is weight in gram and L is total lenght of fish in mm. The "a" and "b" parameters were determined according to the power regression model. The "b" value for each species was tested by a t-test at the 0.05 significance level to verify if it was significantly different from 3 [41-44]

Sex determination of fish was examined by macroscopic gonad morphology after dissection (45). Gonads were separated from fish body and weighed and subsequently preserved in Gilson solution. Seasonal change in gonad mass for both sexes was determined using the gonado somatic index (GSI). GSI calculated as GSI (%) = 100 x (weight of gonad / weight of fish) [41, 46-47].

13. Results

Cluster analysis of water level generated a dendrogam as shown in Figure 2 grouping 12 month into four clusters. Water level values nearly the same in the beginning of low water level (LWL) and beginning of flooding, put both in one cluster. In fact, they were in two difference cluster. Therefore, there were actually five clusters as shown in Figure 2, i.e. Clusters I (December 2012, January 2013, March 2013) representing inundation periods, Cluster II (February 2013) representing a highest water level, Cluster III (April 2013) representing the beginning of low water level, Cluster IV (May 2013, June 2013, July 2013 and August 2013) representing low water level or dry season, and Cluster V (September 2013, October and November 2013) representing the beginning of next flooding season. This grouping, then, is used to compare seasonal trophic state index in floodplain area.

The ratio of TN : TP in all stations sampling for five cluster and two season shows in Table 2. The TN:TP values sumarized for two season shows that flood season higher than dry season unless on contrary in the riverine system (KH and LH). Actual concentration value of both TN and TP were high (range of mean values 43.03-57.08 mg/L and 2.64-4.93 mg/L, respectively) (Table 3).

Commented [S59]: were shown

Trophic status of floodplain based on Carlson's TSI and TLI value in each cluster shown in Figure 3 and 4. The highest mean TSI and TLI values is in dry periods (cluster IV) (Figure 3 and 4). This pattern also found in seasonal Trophic status of floodplain based on Carlson's TSI and TLI value (Figure 5), that the mean values of TSI and TLI tend to higher in the dry season than in flood season. The TSI and TLI nutrients (TP and TN) were higher than TSI and TLI both secchi depth and chlorophyll-a (Figure 4-6). Based on the mean of TSI values among stations (Figure 5), the highest TSI values was on channels plantation (CP).

Based on two-tailed t-test results, there were no significant mean difference of TSI and TLI among clusters (t-value 1.07), among stations in clusters (t-value 2.16), and between seasons (t-value 1.92), but significant mean difference among stations in seasons (t-value 2.29).

This study results showed that the "b" value from LWR (Figure 8) show that "b" values of most of fish were more than 3 (Figure 6). Meanwhile the GSI of three species of fishes in Lubuk Lampam showed in Figure 7.

14. Discussion

High concentration of TN and TP in LLF due to high nutrient in this area. Result study from Venterink *et al*. [48] shows the importance of floodplain for nutrient retention mainly for Nitrogen and Phosphorus. It's caused high concentration of these two nutrients in floodplain area. Otherwise, ratio TN : TP some of stations were tend to phosphorus as limitting factors (TN:TP > 30) and several were balance (10:1≤ TN/TP ≥30:1).

Based on TSI and TLI all of clusters are on hyper-eutrophic status. The hyper-eutrophic status of Lubuk Lampam affected by both natural characteristis and anthropogenic substances. Naturally, floodplain rivers is high productivity ecosystem [49]. Develophment of oil palm plantations in recent years could be the sources of anthropogenic susbtances in Lubuk Lampam. According to Huibin [20], lake that was at eutrophic and hypereutrophic levels, mainly affected by natural condition and anthropogenic activities such as domestic sewage, industrial and non-point source pollution. Organic pollutants, fertilizer-born nutrients (mainly nitrogen and phosphorus) and heavy metals can reach water coarses through direct discharge, leaching or with eroded soil particles [50].

Trophic state of floodplain affected by season. According to Junk and Bayley [51], floodplain are most productive during the dry season. It could be happen because in the dry season, trophic status which is greatly influenced by the optimal primary productivity that supported by optimal light intensity and avaibility of nutrient. Eventhough, Junk [26] stated that in many river floodplains, the input of fertile sediments and dissolved nutrients that be carried by flooding was the main caused of the high productivity in many floodplain rivers.

High TSI nutrients (TP and TN) affected by high concentration of these two nutrients. According to Richardson [18], a large proportion of phosphorus in freshwater occurs as organic phosphates and cellular constituents in the biota or is adsorbed to inorganic and dead particulate matter. Highly TP and TN in floodplain mainly composed by particulate form. It's shows from the comparing values between TP and orthophosphate as dissolved form, also between TN and dissolved nitrogen form i.e. nitrate and nitrite (Table 3). Noe and Hupp [52] stated that High TP and TN concentration caused by constituents entering the floodplain flowpath during flooding. The TP concentration of floodplain is large and it's caused mainly by particulate P fractionation. Meanwhile, high TN during flooding caused by the decreasing 6% of dissolved organic nitrogen (DON) and increasing 5% of particulate organic nitrogen (PON).

The area of channel plantation (CP) was the highest TSI values and this area also categorized highly polluted [27]. According to Dembkowski [53], runoff from agricultural fields may contain high concentration of phosphorus and nitrogen-based pesticides and fertilizers, contributing to eutrophication. This station has high concentration of nutrients i.e. phosphorus and nitrogen (Table 3) and also tend to contaminated by several anthropogenic subtances (Table 4). Eventhough the concentration of contaminants were less than results studies from several researchers and many environmental and public health regulatory authorities [54-63], unless oil and Grease consentration was above the permissible value (PV) (1 mg/L) from Indonesian Government Regulation No. 82/2001 [64].

In spite of the two-tailed t-test result showed that significant mean difference among stations in season, but considering to the clasification values criteria, all stations were in hyper-eutrophic state. Hence, we can use this two formulas eventhough Wu *et al.* [65] suggested to use TLI because simpler, faster and more accurate. On the other hand, several researchers [17-18] suggested to use TSI if TP as limitting factors, and use TLI if TN as limitting factors or nutrient balance.

Relationship between trophic state habitat and lenght-weight relationship (LWR) reported by Moutopoulos [66]. This study results showed that the "b" value from LWR were estimated for 3 species of fishes representing fishes floodplain group based on Welcomme [41] and also representing different food habit (*O. hassseltii* and *H. temmincki* tend to herbivore, whereas the *C. striata* is carnivora [25,67-68]. The "b" values of most of fish were more than 3 mean that the fish becomes weighter as its grows and also showing the area offers good condition to these population [69-70]. The TSI values related to food avaibility for fish [63]. Abundant food supply and sufficient space area throughout the year were probably some of the main factors contributing to the steady increase in fish weight and lenght [42-70].

The GSI of fish as one of reproductive indicators also can be used to represent influence of trophic state to reproductive pattern of fish. The high tropic state on cluster IV and V cause GSI of three species of fishes also high. GSI of fish is

Commented [S60]: were
Commented [S61]: showed
Commented [S62]: it is
Commented [S63]: moreover
Commented [S64]: course
Commented [S65]: hapus
Commented [S66]: hapus
Commented [S67]: hapus
Commented [S68]: hapus
Commented [S69]: however
Commented [S70]: hapus
Commented [S71]: cause
Commented [S72]: high
Commented [S73]: it is

higher in eutrophic water than oligotrophic, it's may be a result of greater nutrient availability [71].

15. Conclusions

Based on Carlson's TSI and TLI formula indicated that Lubuk Lampam is on the hypertrophic state. In the case of floodplain rivers, these two methods can be used. The high trophic status of aquatic system gave positive effect to addition of weight and GSI of fish.

Commented [S74]: , it was

Commented [S75]: In hypereutrophic

Commented [S76]: This research

Commented [S77]: those

Commented [S78]: additional

Acknowledgement

Financial support was received from scholarship of Directorate General of Higher Education, Ministry of Education and Culture, Indonesia. We are grateful to Laboratory of Fisheries, and also Laboratory of chemical, biological and productivity of soil, Faculty of Agriculture, Sriwijaya University; Laboratory of Productivity and Environmental also Laboratory of Biology Departement of Fisheries Resources Management, Bogor Agricultural University; Research Institute for Inland Water Fisheries; and Laboratory of Agrochemicals Residues, Environmental Research Institute, Ministry of Agriculture, Indonesia.

References

[1] Dodds, W.K. 2014. Eutrophication and trophic state in rivers and streams. Limol. Oceanogr. 51 (1.2): 671-680.
[2] Dodds, W.K. 2007. Trophic state, eutrophication and nutrient criteria in streams.Trends in Ecology and Evolution. 22 (12): 669-676 , www.sciencedirect.com. doi:10.1016/j.tree.2007.07.010.
[3] Hua, C.H., Ming, H.W., Asit, M., Yan, L. Trophic state, natural organic matter content, and disinfection by-product formation potential of six drinking water reservoirs in the Pearl River Delta, China. Journal of Hydrology. 359 : 164-173. www.elsevier.com/locate/jhydrol. doi:10.1016/j.jhydrol.2008.06.024.
[4] Carey, C.C and Rydin, E. 2011. Lake trophic status can be determined by the depth distribution of sediment phosphorus. Limnol. Oceanogr. 56(6) 2051–2063. doi:10.4319/lo.2011.56.6.2051
[5] Nawrocka, J and Kobos, J. 2011. The trophic state of the Vistula Lagoon : an assessment based on selected biotic and abiotic parameters according to the water framework directive. Oceanologia.53(3): 881-894. http://www.iopan.gda.pl/oceanologia/doi:10.5697/oc.53-3.881
[6] Schaedel, A. 2011. Oregon DEQ harmful algal bloom (HAB) strategy, Appendix D. DEQ State of Oregon Department of Environmental Quality. p.8.
[7] Carlson, R.E. 1977. A trophic state index for lakes. Limnology and Oceanography. 22 (2) : 361-369.
[8] Rakocevic-Nedovic, J and Hollert H. 2005. Phytoplankton community and chlorophyll *a* as trophic state indices of Lake Skadar (Montenegro, Balkan). Environ Sci & Pollut Res. 12(3)146–152. http://dx.doi.org/10.1065/espr2005.04.241
[9] Galvez-Cloutier, R and Sanchez, M. Trophic status evaluation for 154 Lakes in Quebec, Canada: monitoring and recommendations. Water Qual. Res. J. Canada. 42(4): 252-268.
[10] Murthi, G.P., Shivalingaiah, B.C., Leelaja, S.P., Hosmani. 2007. Trophic state index in conservation of lake ecosystems. Proceedings of Taal 2007 : The 12th World lake Conference. pp. 840-843.
[11] Elmaci, A., Ozengin, N., Teksoy, A., Topac, F.O., Baskaya, H.S. Evaluation of trophic state of lake Uluabat, Turkey. Journal of Environmental Biology. 30(5): 757-760. www. jeb.co.in.
[12] Molisani, M.M., de Sousa Barosso, H., Becker, H., Moreira, M.O.P., Hijo, C.A.G., de Monte, T.M., Vasconcellos, G.H. Trophic state, phytoplankton assemblages and limnological diagnosis of the Castanhão Reservoir, CE, Brazil. Acta Limnologica Brasiliensia. 22(1): 1-12. doi: 10.4322/actalb.02201001.
[13] Prasad, A.G.D and Siddaraju. 2012. Carlson's trophic state index for the assessment of trophic status of two Lakes in Mandya district. Advanced in Applied Science Research. 3(5): 2992-2996. www.pelagiaresearchlibrary.com.
[14] Rahmati, R., Pourgholam, R., Najafpour, S.H., Doudstdar, M. 2011. Trophic status of a Shallow Lake (North of Iran) based on the water quality and the phytoplankton community. World Applied Sciences Journal14 (special issue of food and environment).pp. 112-120
[15] Rahul, U., Arvind, P.K., Upadhyay, S.K. 2013. Assessment of lake water quality by using Palmer and Trophic State Index- a case study of Upper Lake, Bhopal, India. International Research Journal Environment Sciences. 2(5): 1-8. www.isca.in.
[16] Thomatou, A.A., Triantafyllidu, M., Chalkia, E., Kehayias, G., Konstantinou, I. Zacharias, I. 2013. Land use changes do not rapidly change the trophic state of a deep lake Amvrakia Lake, Greece. Journal of Environmental

protection. 4: 426-434. http://www.scirp.org/journal/jep. doi:10.4236/jep.2013.45051.
[17] Sigua, G.C., Williams, M.J., Coleman, S.W., Starks, R. 2006. Nitrogen and phosphorus status of soils and trophic state of lakes associated with Forage-Based Beef Cattle operations in Florida. J. Environ. Qual. 35:240–252. doi:10.2134/jeq2005.0246
[18] Richardson, J. 2010. Water Quality Report for Selected Lakes and Streams. Leon County Public Works. Division of Engineering Services., 2010. p. 278
[19] Yaoyang, X., Meiling, S., Xinqin, H. Qinghua, C. 2010. Temporal asynchrony of trophic status between mainstream and tributary bay within a giant dendritic reservoir: the role of local-scale regulators. Water Air Soil Pollut. p.14. DOI 10.1007/s11270-010-0705-5.
[20] Huibin, Y., Beidou, X., Jinyuan, J., Heaphy, M.J., Hailong, W., Dinglong, L. 2011. Environmental heterogeneity analysis, assessment of trophic state and source identification in Chaohu Lake, China. China, Environ Sci Pollut Res. 18:1333-1342. DOI 10.1007/s11356-011-0490-8.
[21] Burns, N., Bryer, G., Bowman, E. 2000. Protocols for monitoring trophic levels of New Zealand lakes and reservoir. Ministry for the environmen, Wellington, New Zealand. p.130.
[22] Meredith, A and Wilks, T. Canterbury high country lakes water quality monitoring programme : results of the third year monitoring 2007. Environment Canterbury, 2007,p.39.
[23] Al-Abbawy D.A.H. 2012. Assesment of trophic status for Shatt Al-Arab river using trophic state index (TSI). Journal of Basrah Researches (Sciences). 38 (3.A): 36–44.
[24] Chaurasia, S., Dwivedi, R., Karan, R. 2013. Water quality and trophic status of the River Sai at Raibareli, Uttar Pradesh, India. Int. J. Curr. Sci. 9 : E 15-18. www.currentsciencejournal.info
[25] Welcomme, R.L. 1985. River Fishes. FAO Tech. Bull. 262, Rome. p.330.
[26] Junk, W.J. 1996. Perspectives in Tropical Limnology. In: Schiemer, F., Boland, K.T. (eds.), SPB Academic Publishing by Amsterdam, The Netherlands, 1996, p. 255.
[27] Jubaedah, D., Hariyadi, S., Muchsin, I., Kamal. M.M. 2014. Water Quality Index of Floodplain River Lubuk Lampam South Sumatera Indonesia. Proceeding of 4th International Conference on Environmental and Agriculture Engineering, Singapore.p.192
[28] Husnah. 2008. Potential Threat to the Floodplain Ecosystem of Lempuing River, South Sumatera. In: Hartoto, D.I., Koeshendrajana, S., Kartamihardja, E.S., Utomo, A.D., Nasution Z. (eds.),Fisheries Ecology and Management of Lubuk Lampam Floodplain Musi River, South Sumatera, Research Institute for Inland Water Fisheries, Ministry of Marine and Fisheries Affairs, Palembang. pp.149-155
[29] APHA. 1998.Standar methods for the examination of water and wastewater. 18th edition, APHA, AWWA and WPCF,
[30] Wenzhi, L., Quanfa, Z., Guihua, L. 2011. Effects of watershed land use and lake morphometry on the trophic state of Chinese lakes: implications for eutrophication control. Clean-soil, air, water. 39(1): 35-42. www.clean-journal.com. 10.1002/clen.201000052.
[31] Burns, N., McIntosh, J., Scholes, P. 2005. Strategies for managing the lakes of the Rotorua District, New Zealand. Lake and Reserv. Manage. 21(1) : 61-72
[32] Hamilton, D and Parparov, A. 2010. Comparative assessment of water quality with the Trophic Level Index and the Delphi Method in Lakes Rotoiti and Rotorua, NewZealand. Water Qual. Res. J. Can. 45(4): 479-489.
[33] Otago Regional Council. 2005. Lake Waipori and Lake Waihola : Trophic Level Status. Lake Waipori & Lake Waihola Trophic Level Status Report p.53.
[34] Castellano, S. 2013. A project Report in partial fulfillment of the requerements for the degree of Master of Sciences. Departement of Civil and Environmental Engineering, Brigham Young University.p.164
[35] Hughes, P.E. 1993. Water-Resources investigation report 91-4076.
[36] Welling, M.L., Munzenmaier, M., Waldmer, E., Bourne, J., Sutherland, S.R., Wardius, K., Magruder, C. 2001.Trophic State and Chlorophyll in the Milwauke, Wisconsin Harbor and surrounding nearshore waters. Water quality Reseach Departement Milwaukee Metropolitan Sewerage District. p 38.
[37] Sharma, M.P., Kumar, A., Rajvanshi, S. 2010. Assessment of Trophic State of Lakes: A Case of Mansi Ganga Lake in India. Hydro Nepal. 6:65-71.
[38] Fuller, L.M., Jodoin, R.S., Minnerick, R.J. 2011. U.S. Geological Survey Scientific Investigation Report 2011-5007.
[39] Chaves, F.I.B., Lima, P.F., Leitão, R.C., Paulino, W.D., Santaella, S.T. 2013. Influence of rainfall on the trophic status of a Brazilian semiarid reservoir. Acta Scientrum Biological Sciences, Maringá. 35(4): 505-511. http://www.uem.br/acta. Doi: 10.4025/actascibiolsci.v35i4.18261
[40] Santos, J.C.N., de Andeade, E.M., Neto, J.R.A., Meureles, A.C.M., Palacio HAQ. 2014. Land use and trophic state dynamics in a tropical semi-arid reservoir. Revista Ciência Agronômica. 45(1): 35-44. www.ccarevista.ufc.br.
[41] Welcomme, R.L. 1979. Fisheries Ecology of Floodplain Rivers, Longman Inc., New York. p.317.
[42] Montchowui, E., Kogbeto, M., Laleye, P. 2009. Weight–length relationships for commercial fish species caught in

Lake Hlan in Benin (West Africa). Int. J. Biol. Chem. Sci. 3(3): 612-616. http://www.ajol.info.
[43] Gerami, M.H., Abdollahi, D., Patimar, R. 2013. Length-weight, length-length relationship and condition factor of *Garra rufa* in Cholvar River of Iran. World Journal of Fish and Marine Sciences. 5(4): 358-361. DOI: 10.5829/idosi.wjfms.2013.05.04.7371.
[44] Ezekiel, E.N. and Abowei, J.F.N. 2013. Length-Weight Relationship and Condition Factor of Heterotis niloticus from Amassoma flood plain, Niger Delta, Nigeria. Applied Science Report. 4(1): 164-172. www.pscipub.com/ASR.
[45] Effendie, M.I.. 1979. Metoda Biologi Perikanan, Yayasan Dewi Sri, Bogor.p.112.
[46] Effendie, M.I.. 1997. Biologi Perikanan, Yayasan Nusatama, Yogyakarta.p.163.
[47] Mondal, D.K. and Kaviraj, A. 2010. Feeding and reproductive biology of Indian Shad *Gudusia chapra* in two floodplain lakes of India. Electronic Journal of Biology. 6(4): 98-102.
[48] Venterink, H.O., Wiegmab, F., Van der lee, G.E.M., Vermaat, J.E. 2003. Role of avtive floodplains for nutrinet retention in the river Rhine. J. Environ. Qual. 32 : 1430-1435
[49] Graham, R and Harris, J.H. 2005. Floodplain inundation and fish dynamics in the Murray-Darling Basin. Current concepts and future research : a scoping study. CRC for Freshwater Ecology. p.56
[50] Lair, G.J., Zehetner, F., Fiebig, M., Gerzabek, M.H., Van Gestel, C.A.M., Hein, T., Hohensinner, S., Hsu, P., Jones, K.C., Jordan, G., Koelmans, A.A., Poot, A., Slijkerman, D.M.E., Totsche, K.U., Bondar-Kunze, E., Barth, J.A.C. 2009. How do long-term development and periodical changes of river–floodplain systems affect the fate of contaminants? Results from European rivers. Environmental Pollution. 157:3336-3346. www.elsevier.com/locate/envpol. doi:10.1016/j.envpol.2009.06.004.
[51] Junk, W.J. and Bayley, P.B. 2007. The Scope of the Flood Pulse Concept Regarding Riverine Fish and Fisheries, Given Geographic and Man-Made Differences between Systems. Proceeding of the American Society Syposiun 49, American Fisheries Society.p.587.
[52] Noe, G.B. and Hupp, C.R. 2007. Seasonal variation in nutrient retention during inundation of a short-hydroperiod floodplain. River Research and Applications. 23: 1088-1101. www.interscience.wiley.com. DOI: 10.1002/rra.1035.
[53] Dembkowski, D.J. 2011. Fish biodiversity in floodplain lakes of the Mississipi aluvial valey. Master Sciences Thesis, Faculty of Mississippi State University, United States. p.82
[54] Eisler, R. 1990. Paraquat Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. Biological Report. 85 (1.22). U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland.p.38.
[55] Adak, A., Pal, A., Bandyopadhyay, M. 2005. Spectrophotometric determination of anionic surfactants in wastewater using acridine orange. Indian Journal of Chemicl Technology. 12: 145-148
[56] WHO. 2005. Glyphosate and AMPA in drinking waters. http://www.who.int/water" sanitationhealth.p.19.
[57] Davis, A., Lewis, S., Bainbridge, Z., Brodie, J., Shannon, E. 2008. Pesticide residues in waterways of the lower Burdekin region : challenges in ecotoxicological interpretation of monitoring data. Australian Journal of Ecotoxicology. 14:89-108
[58] Singh, R.P., Ibrahim, M.H., Esa, N., Illiyana, M.S. 2010. Composting of waste from palm oil mill: a sustainable waste management practice. Rev. Environ. Sci. Biotechnol. 9: 331-344. DOI 10.1007/s11157-010-9199-2
[59] Ghoochani, M., Shekoohiyan, S., Mahvi, A.H., Haibati, B., Norouzi, M. 2011. Determination of Detergent in Tehran Ground and Surface Water. American-Eurasian Agric. & Environ. Sci. 10 (3) 464-469.
[60] Coupe, R.H., Kalkhoff, S.J., Capel, P.D., Gregorie, C. 2011. Fate and transport of glyphosate and aminomethylphosphonic acid in surface waters of agricultural basins. Pest. Manag. Sci. wileyonlinelibrary.com) DOI 10.1002/ps.2212.
[61] Shia, C., Yabu, M., Tran, K.V., Young, M.S. 2013. Improved resolution for paraquat and diquat : drinking water analysis using the CORTECS UPLC HLIC column. Waters, the sciences of what's posible. http://www.water.com. p.8.
[62] Kumar, R.T., Sampson, A., Dorathy, E., Wokoma, I., Ablorh, M.A. 2013. Study on environmentl impact on oil and gas activities in Ghana- Analysis by graphical approaches using Matlab. International Journal of Engineering Trends and Technology. 4(3): 344-348. http://www.internationaljournalssrg.org
[63] Oliver, D.P., Anderson, J.S., Davis, A., Lewis, S. Brodie, J., Kookana, R. 2014. Banded applications are highly effective in minimising herbicide migration from furrow-irrigated sugar cane. Science of the Total Environment. 466–467: 841–848 .www.elsevier.com/locate/scitotenv.
[64] Indonesia Goverment Regulation. 2001. Regarding Water Quality Management and Water Pollution Control, No. 82/2001.
[65] Wu, Z., Jie, R., Chen, S., Xin, Y., Liang, Y. 2012. Spatial-Time Comparative Analysis and Evaluation of Eutrophication Level of Nansi Lake. Asia Pacific Conference on Environmental Science and Technology, Advances in Biomedical Engineering. 6: 485-491.

[66] Moutopoulos, D.K., Koukou, K., Vavarouta, V., Ramfos, A., Katselis, G. 2011. Investigation of Length-Weight Relationships for 10 commercial fish species as a possible trophic state index of Coastal Lagoons. ACTA ADRIAT. 52(2): 261 – 268.
[67] Buchar, T., Handayani, T., Najamuddin, A. 2007. Ichtio-fauna danau Batu, Kalimantan Tengah. Journal of Tropical Fisheries. 2 (2): 188-200.
[68] Swingle, H.S and Allison, R. 1971. The inland fisheries progress 1970, Project report : AID/csd-2770, USOM/Thailand PIOT 493-180-3-80413, International Center for Aquaculture Auburn University, Auburn, Alabama,
[69] Akombo, P.M., Akange, E.T., Adikwu, I.A., Araoye, P.A. 2014. Length-weight relationship, condition factor and feeding habits of *Synodontis schall* (Bloch and Schneider, 1801) In river Benue at Makurdi, Nigeria. International Journal of Fisheries and Aquatic Studies. 1(3): 42-48. www.fisheriesjournal.com.
[70] Ikongbeh, O.A., Ogbe, F.G., Solomon, G. 2012. Length-weight relationship and condition factor of *Bagrus docmac* from Lake Akata, Benue state, Nigeria. Journal of Animal&Plant Sciences. 15(3): 2267-2274. http://www.m.elewa.org/JAPS
[71] Writer, J.H., Barber, L.B., Brown, G.K., Taylor, H.E., Kiesling, R.L., Ferrey, M.L., Jahns, N.D. Bartel, S.E. 2010. Anthropogenic tracers, endocrine disrupting chemicals, and endocrine disruption in Minnesota lakes. Science of the Total Environment. 409:100-111. www.elsevi e r.com/locate/scitotenv. doi:10.1016/j.scitotenv.2010.07.018

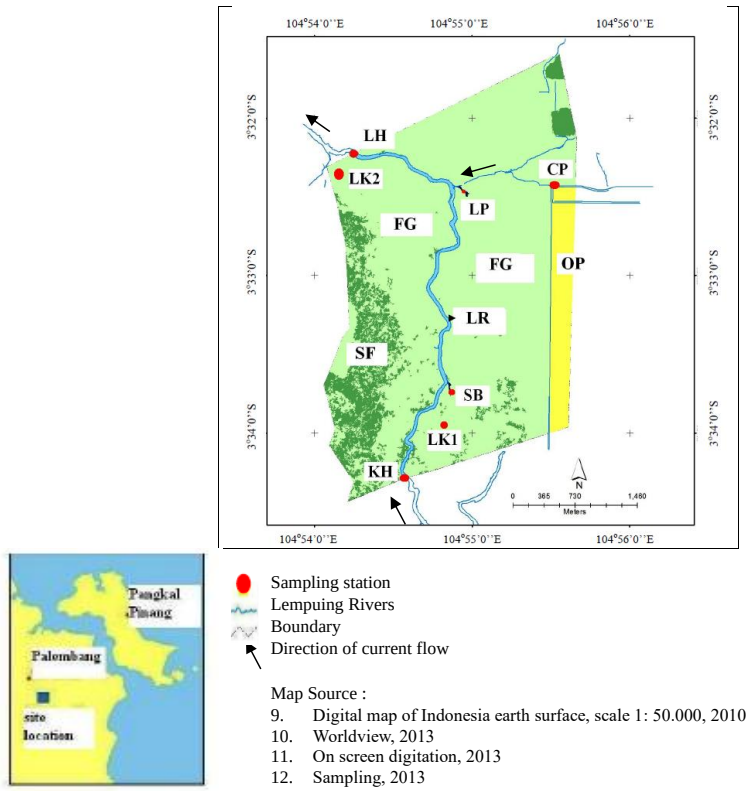


Figure 1. Study area and sampling sites : Kapak Hulu (KH), flooded grassland 1 (LK1), Suak Buayo (SB), Lebung Proyek (LP), channels of oil palm plantations (CP), flooded grassland 2 (LK2), and Lempuing Hilir (LH), Flooded grassland (FG), flooded forest (SF), Lempuing river (LR), and oil palm plantation (OP).

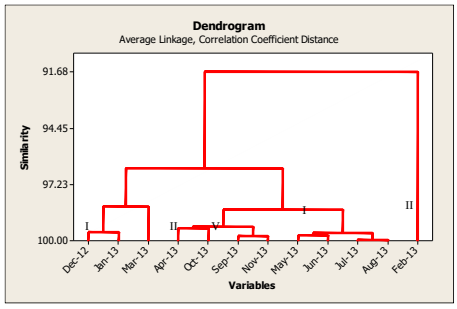


Figure 2. Cluster Analysis results of water Depth

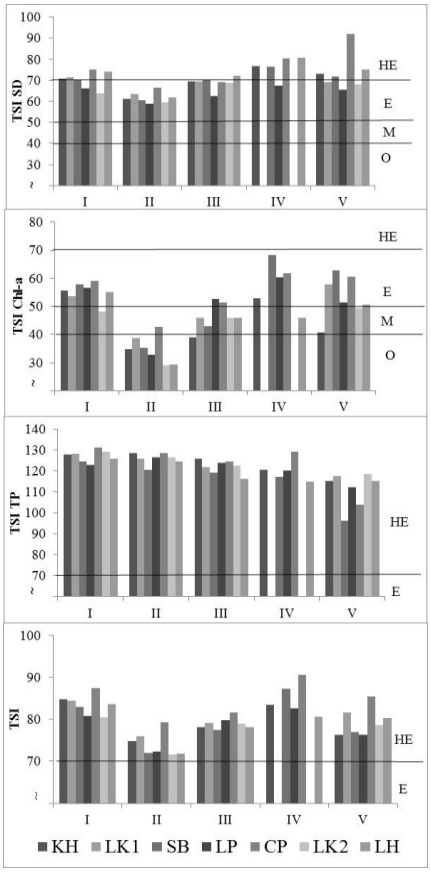


Figure 3. TSI values in each stations (KH, LK1, SB, LP, CP, L2, LH) and clusters (I, II, III, IV, V); HE (Hyper-eutrophic), E (Eutrophic), M (Mesotrophic), O (Oligotrophic)

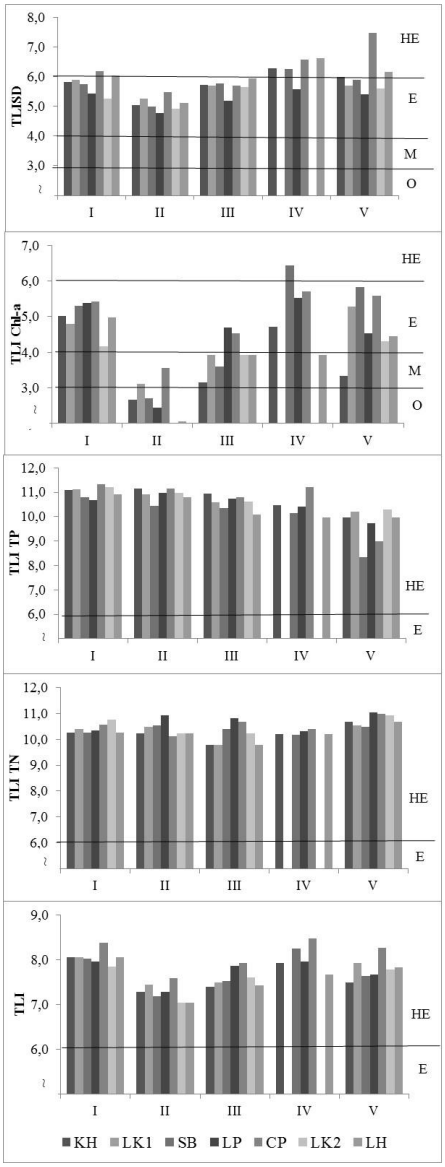


Figure 4. TLI values in each stations and clusters

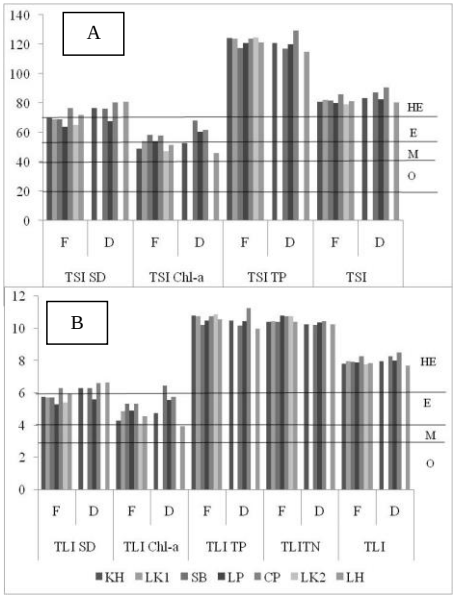


Figure 5. Seasonal values of TSI (A) and TLI (B), F (Flood season), D (Dry season)

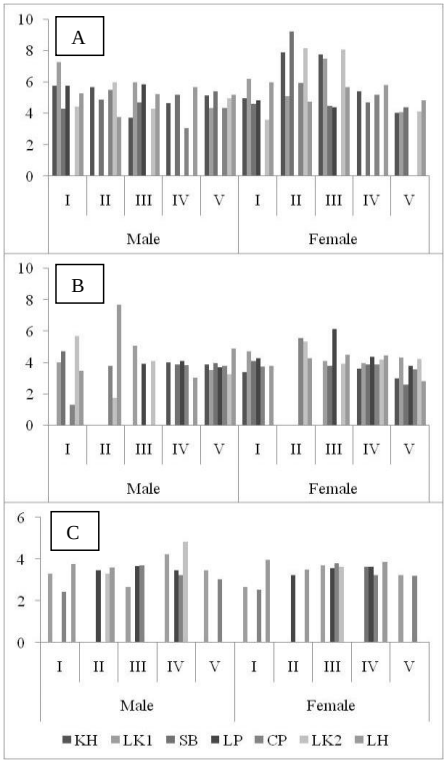


Figure 6. "b" values from fish lenght-weight relationship : (A) *O. hasselti,* (B) *H. temminckii,* and (C) *C. Striata,* Cluster (I, II, III, IV, and V)

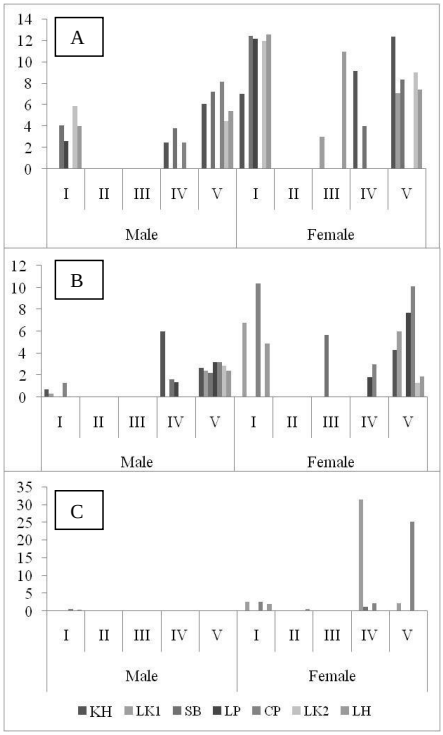


Figure 7. GSI : (A) *O. hasselti, (*B) *H. temminckii*, and (C) *C. Striata*, Cluster (I, II, III, IV, and V)

Table 1. TSI and TLI Classification values

Trophic state	TSI level*)	TLI level**)
Oligotrophic (O)	< 40	< 3.0
Mesotrophic (M)	40< TSI ≤50	3.0< TSI ≤4.0
Eutrophic (E)	50<TSI≤70	4.0<TSI≤6.0
Hyper-eutrophic (HE)	>70	>6.0

*) TSI Level adopted and modified from some references [6, 9, 17, 30, 34-40]
**) TLI level based on Castellano [34]

Table 2. Ratio TN : TP (mol)

Station	Cluster					Season	
	I	II	III	IV	V	Flood	Dry
KH	17	16	13	27	56	24	27
LK1	18	23	18	-	43	25	-
SB	21	35	34	33	176	38	33
LP	25	31	34	30	90	41	30
CP	18	14	30	17	155	32	17
LK2	22	18	24	-	58	30	-
LH	21	21	47	42	56	32	42

- : no observation at dry season

Table 3. Mean of concentration of TN, TP, nitrite, nitrate and orthophosphate (mg/L)

Station	TN	TP	Nitrite	Nitrate	Ortho-phosphate
KH	43.03	3.90	0.30	2.67	0.08
LK1	44.42	4.22	0.02	1.96	0.11
SB	46.88	2.64	0.25	3.07	0.07
LP	53.90	3.06	0.20	2.76	0.10
CP	53.12	**4.93**	**0.30**	**4.53**	**0.16**
LK2	**57.08**	4.41	0.02	1.70	0.07
LH	44.41	2.92	0.17	2.88	0.12

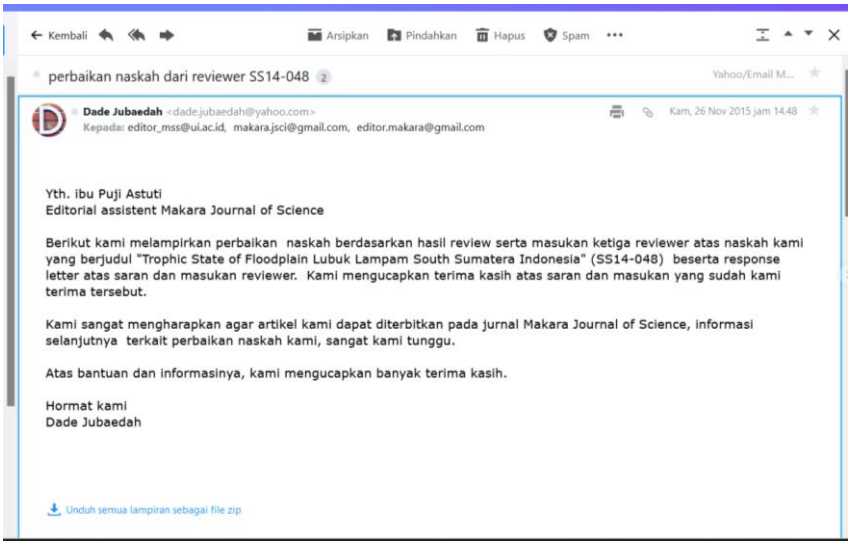
Bold characters are the highest value

Table 4. Antrophogenic substances concentration (mg/L)

Stations	oil and grease	Detergent	Glyphosate	Paraquat
KH	1.725	0.056	0.003	0.003
LK1	0.750	0.041	0.002	0.003
SB	2.500	0.061	0.003	0.003
LP	2.125	0.065	**0.005**	**0.011**
CP	**4.250**	**0.071**	0.002	0.004
LK2	0.500	0.028	0.001	0.002
LH	3.125	0.046	0.005	0.003

Bold characters are the highest value

4. Bukti Revisi dan penerimaan hasil revisi (26 dan 27 November 2015)



← Kembali Arsipkan Pindahkan Hapus Spam •••

perbaikan naskah dari reviewer SS14-048 (2)

Dade Jubaedah <dade.jubaedah@yahoo.com>
Kepada: editor_mss@ui.ac.id, makara.jsci@gmail.com, editor.makara@gmail.com
Kam, 26 Nov 2015 jam 14.48

Yth. ibu Puji Astuti
Editorial assistent Makara Journal of Science

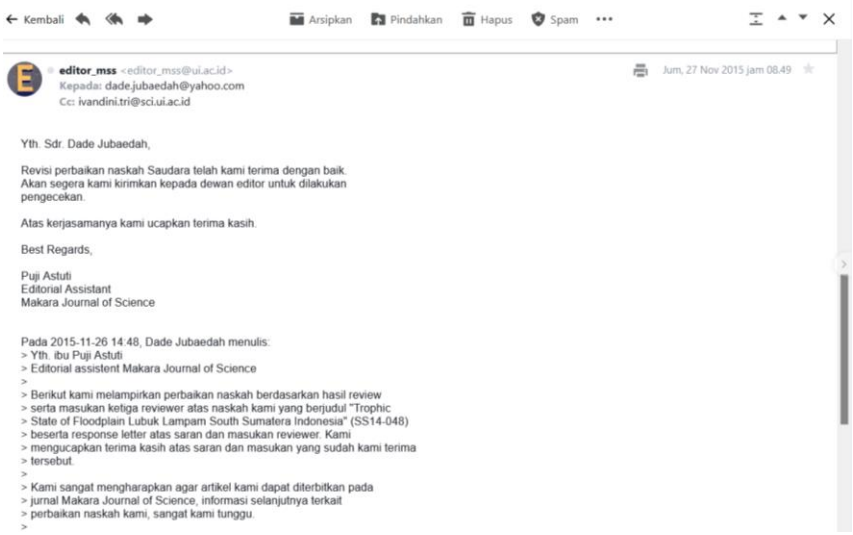
Berikut kami melampirkan perbaikan naskah berdasarkan hasil review serta masukan ketiga reviewer atas naskah kami yang berjudul "Trophic State of Floodplain Lubuk Lampam South Sumatera Indonesia" (SS14-048) beserta response letter atas saran dan masukan reviewer. Kami mengucapkan terima kasih atas saran dan masukan yang sudah kami terima tersebut.

Kami sangat mengharapkan agar artikel kami dapat diterbitkan pada jurnal Makara Journal of Science, informasi selanjutnya terkait perbaikan naskah kami, sangat kami tunggu.

Atas bantuan dan informasinya, kami mengucapkan banyak terima kasih.

Hormat kami
Dade Jubaedah

Unduh semua lampiran sebagai file zip



← Kembali Arsipkan Pindahkan Hapus Spam •••

editor_mss <editor_mss@ui.ac.id>
Kepada: dade.jubaedah@yahoo.com
Cc: ivandini.tri@sci.ui.ac.id
Jum, 27 Nov 2015 jam 08.49

Yth. Sdr. Dade Jubaedah,

Revisi perbaikan naskah Saudara telah kami terima dengan baik.
Akan segera kami kirimkan kepada dewan editor untuk dilakukan pengecekan.

Atas kerjasamanya kami ucapkan terima kasih.

Best Regards,

Puji Astuti
Editorial Assistant
Makara Journal of Science

Pada 2015-11-26 14:48, Dade Jubaedah menulis:
> Yth. ibu Puji Astuti
> Editorial assistent Makara Journal of Science
>
> Berikut kami melampirkan perbaikan naskah berdasarkan hasil review
> serta masukan ketiga reviewer atas naskah kami yang berjudul "Trophic
> State of Floodplain Lubuk Lampam South Sumatera Indonesia" (SS14-048)
> beserta response letter atas saran dan masukan reviewer. Kami
> mengucapkan terima kasih atas saran dan masukan yang sudah kami terima
> tersebut.
>
> Kami sangat mengharapkan agar artikel kami dapat diterbitkan pada
> jurnal Makara Journal of Science, informasi selanjutnya terkait
> perbaikan naskah kami, sangat kami tunggu.
>

Trophic State of Floodplain Lubuk Lampam South Sumatera Indonesia

Dade Jubaedah[1], M. Mukhlis Kamal[2*)], Ismudi Muchsin[2)], Sigid Hariyadi[2)]

1. Study Program of Aquaculture, Faculty of Agriculture, Sriwijaya University, Palembang 30662, Indonesia
2. Departement of Aquatic Resources Management, Faculty of Fisheries and Marine Sciences, Bogor Agricultural University, Bogor 16680, Indonesia

*)*E-mail : mm-kamal@ipb.ac.id.*, phone/fax. : 0251-622932/0251-8622907

Abstract

Trophic state of Lubuk Lampam floodplain river was affected by natural change of water level fluctuation. The ecosystem also receives substantial load of nutrient and other chemical resulting from the anthropogenic activities, especially from oil palm plantation and it's industrial processing. The main objective of this research was to determine trophic state of the floodplain river area using Carlson's trophic state index (TSI) and trophic level index (TLI). The water quality and fish samples were collected and analyzed from 7 stations that representing types of habitat of the floodplain. The results showed that based on those two methods, the trophic state of Lubuk Lampam were hyper-eutrophic. This trophic status was supported by the substantial additional weight ("b" value more than 3) and gonado somatic index (GSI) of fish were *Osteochillus vittatus* 2.53-6.81% % (male) and 3.00-15.86% (female); *Helostoma temminckii* 0.28-3.33% (male) and 1.30-10.43% (female); *Channa striata* 0.33-0.59% (male) and 0.21-2.73% (female).

Key words : floodplain rivers, trophic state, Lubuk Lampam

Abstrak

Status Trofik Rawa Banjiran Lubuk Lampam, Sumatera Selatan. Rawa banjiran Lubuk Lampam merupakan ekosistem yang secara alamiah dipengaruhi oleh fluktuasi tingkat muka air. Ekosistem ini juga menerima bahan masukan antropogenik berupa nutrien dan bahan kimia pertanian terutama dari perkebunan kelapa sawit dan industri pengolahannya. Penelitian ini bertujuan untuk menentukan status trofik untuk rawa banjian menggunakan *Trophic State Index* (TSI) dari Carlson dan *Trophic Level Index* (TLI). Pengambilan dan analisis kualitas air dan ikan pada 7 stasiun yang mewakili tipe habitat rawa banjiran. Hasil menunjukkan bahwa berdasarkan dua metode tersebut, Lubuk Lampam berada dalam status hypereutrofik (sangat subur). Indikasi kesuburan ditunjukkan dengan adanya pertambahan berat ikan yang tinggi dan indeks kematangan gonad ikan (*Gonado Somatic Index*, GSI) yang cukup besar yaitu ikan *Osteochillus vittatus* 2.53-6.81% (jantan) dan 3.00-15.86% (betina); *Helostoma temminckii* 0.28-3.33% (jantan) dan 1.30-10.43% (betina); *Channa striata* 0.33-0.59% (jantan) dan 0.21-2.73% (betina)

Kata Kunci : Rawa banjiran, status trofik, Lubuk Lampam

16. Introduction

There are varities of methods used in assessing the trophic state of water bodies from single to multi parameters [1-7]. The most classical and commonly methods used was introduced by Carlson [7-16], i.e. the trophic state index (TSI) in which the calculation is built by total phosphorus, chlorophyll-a, and water transparency. Later, the TSI index has been modified by adding total N into calculation such as trophic level index (TLI) [16-22].

Both Carlson's TSI and TLI are applicable in determining the trophic status on stagnant waters including lakes and reservoirs. However, Carlson [7] stated that TSI was also appropriate to be used in flowing waters including streams and riverine habitats. Some studies show the applicability of TSI in dynamic waters (23-24).

In comparison with lakes and rivers, water body in the floodplain habitats are characterized by both lotic and lentic components [25]. The oscillation between terrestial and aquatic phase resulted from rise and drop of water level. Therefore, the areas are periodically inundated by the lateral overflow of rivers [26].

Since floods originate from three sources i.e. overspill from the river channels, local rainfall, and tides, the fluctuation of these sources will cause the changing of floodplain water qualities and later will influence the trophic status of the floodplain. According to Welcomme [25], the great fluctuation in water level cause a seasonal cycle of flood and drought over large of the area. Extreme changes in water chemistry and primary production also occur throughout the cycle. The trophic status determination of floodplain is important because the indexes can be used as a predictive tool in effective water management programs [7, 20].

Lubuk Lampam is one of important floodplain areas situated in district of Ogan Komering Ilir. The main river of the areas is Lempuing river, one of Komering River tributaries. This area is one of natural floodplain that is important for ecological balance. Meanwhile, this area also important for local economic growth especially from fisheries and agricultural activities [27]. The goverment has determined several sites within the area to be fisheries reserves, i.e. Lebung Proyek, Suak Buayo and Kapak Hulu as shown in Figure 1. The potential threat to this floodplain is identified from the landscape changes such as deforestation and land clearance for agriculture i.e. oil palm plantation and industrial processing. Those are influenced the water quality deriving from leaching of pesticide, fertilizer and other agrochemicals [28].

There is limitted information about trophic state on Lubuk Lampam Floodplain (LLF). This study, therefore, is aimed to asses the trophic status of this floodplain in relation with water level fluctuation and anthropogenic substances mainly from oil palm plantation and its industrial processing.

17. Material and Methods

Seven sampling sites were set up located in the upstream, inside and downstream of LLF (Figure 1), i.e. 1) upper course main river Kapak Hulu (station 1), 2) flooded grassland 1 (station 2), 3) natural floodplain pools Suak Buayo (station 3), 4) man-made floodplain pools Lebung Proyek (station 4), 5) channels of oil palm plantation (station 5), 6) Flooded grassland 2 (station 6), 7) downstream Lempuing Hilir (station 7). Sampling was done monthly at all sites but in the flooded grassland (station 1 and station 6) were took place only during flood season.

Sampling were conducted from December 2012 to November 2013, covering water quality (the whole period with monthly interval), the antrophogenic substances (detergent, herbicide, oil and grease; these parameters were taken only during flooding, highest water level, and dry season period). Water samples were collected, preserved, kept cooled at 4ºC, and analysed based on standard methods [29]. Measurement on total nitrogen (TN) and total phosphorus (TP) were performed by using spectrophotometric analyser. Chlorophyll-a (Chl-a) was collected, preserved with $MgCO_3$ and determined using spectrophotometric methods. Oil and grease was analysed using gravimetric methods, detergent was analysed using spektrophotometric analyser, and herbicide using gas chromatography.

TN:TP criteria are classified into three categories : nitrogen limited (TN/TP < 10:1), phosphorus limited (TN/TP > 30:1), and balanced (10:1≤ TN/TP ≥30:1) [17-18].

Trophic state of Lubuk Lampam is calculated by the Carlson's TSI value [7, 11, 30]. The TSI formula were:

$$TSI_{SD} = 10x[6-(\ln SD/\ln 2)] \quad (1)$$

$TSI_{Chl\ a} = 10x[6-((2.04-0.68\ ln\ Chl\ a)/ln2)]$ (2)

$TSI_{TP} = 10x[6-ln(48/TP)/ln2]$ (3)

$TSI = [TSI\ (P)+TSI\ (chl\ a)+TSI\ (SD)]/3$ (4)

Where, SD = secchi disk transparency (m); Chl = chlorophyll-a (µg/L); P = Total Phosphorus (µg/L)

The modified TSI formula namely the Trophic Level Index (TLI) [31-33] were calculated by:

$TLI_{Chl-a} = 2.22+2.54log_{10}(Chl)$ (5)

$TLI_{SD}=5.10+2.60log_{10}(1/S-1/40)$ (6)

$TLI_{TP}=0.218+2.92log_{10}(TP)$ (7)

$TLI_{TN}=-3.61+3.10log_{10}(TN)$ (8)

$TLI = \Sigma(TLI_{Chl} + TLI_S + TLI_{TP} + TLI_{TN})/4$ (9)

Where, TN = Total Nitrogen (µg/L).

The classification values based on TSI and TLI are shown in Table 1. Both TSI and TLI were analyzed based on stations and season. The Mean of TSI and TLI was tested by a t-test at the 0.05 significance level.

In this study, 3 species of fishes i.e. *Osteochillus vittatus* (n=805), *Helostoma temminckii* (n=793) and *Channa striata* (n=397) were caught in Lubuk Lampam during study. Sample taken by fixed gillnet (0.5. 0.75, 1.0, 1.5, 2.0, 2.5, 3.0- mm mesh size) and portable traps. Samples were measured of total lenght (TL) and total wet weight for each species.

The length of the fish was measured to the nearest 0.5 mm, and the weight to the nearest of 0.01 mg. The lenght-weight relationship (LWR), $W=aL^b$ was converted to logarithmic expression : log W = Log a + b log L. In this formula W is weight in gram and L is total lenght of fish in mm. The "a" and "b" parameters were determined according to the power regression model. The "b" value for each species was tested by a t-test at the 0.05 significance level to verify if it was significantly different from 3 [41-44]

Sex determination of fish was examined by macroscopic gonad morphology after dissection (45). Gonads were separated from fish body and weighed and subsequently preserved in Gilson solution. Seasonal change in gonad mass for both sexes was determined using the gonado somatic index (GSI). GSI calculated as GSI (%) = 100 x (weight of gonad / weight of fish) [41, 46-47].

18. Results

Water level fluctuation as shown in Figure 2 grouping 12 month into 3 season, i.e. first flood or inundation season (FS1), low water level or dry season (DS), and second flood or nundation season (FS2). This grouping, then, is used to compare seasonal trophic state index in floodplain area.

The ratio of TN : TP in all stations sampling for each season were shown in Table 2. The TN:TP values sumarized for each season shows that second flood season higher than first flood season and dry season. Actual concentration value of both TN and TP were high for each season and station (Table 3).

Trophic status of floodplain based on Carlson's TSI and TLI value in each stations and seasons were shown in (Figure 3 and 4). The mean values of TSI and TLI were shown that LLF was on hyper-eutrophic status. TSI and TLI nutrients (TP and TN) were higher than TSI and TLI both secchi depth and chlorophyll-a (Figure 3-4). TSI and TLI values of dry season higher than flood season, meanwhile based on the mean of TSI and TLI values among stations (Figure 3-4), the highest TSI and TLI values was on channels plantation (CP). Based on two-tailed

t-test results, there were no significant mean difference of TSI and TLI among stations (t-value 1.95), and among seasons (t-value 1.36).

This study results showed that the "b" value from LWR show that "b" values of most of fish were more than 3 (Figure 5). Meanwhile the GSI of three species of fishes in Lubuk Lampam showed in Figure 6. GSI values of *O. vittatus* 2.53-6.81 (male) and 3.00-15.86 (female); *H. temmincki* 0.28-3.33% (male) and 1.30-10.43% (female); *C. striata* (0.33-0.59% (male) and 0.21-2.73% (female)

19. Discussion

High concentration of TN and TP in LLF were due to high nutrient in this area. Result study from Venterink *et al*. [48] showed the importance of floodplain for nutrient retention mainly for Nitrogen and Phosphorus. It is caused high concentration of these two nutrients in floodplain area. Moreover, ratio TN : TP some of stations were tend to phosphorus as limitting factors (TN:TP > 30) and several were balance (10:1≤ TN/TP ≥30:1).

Based on TSI and TLI all of clusters are on hyper-eutrophic status. The hyper-eutrophic status of Lubuk Lampam affected by both natural characteristis and anthropogenic substances. Naturally, floodplain rivers is high productivity ecosystem [49]. Develophment of oil palm plantations in recent years could be the sources of anthropogenic susbtances in Lubuk Lampam. According to Huibin [20], lake that was at eutrophic and hypereutrophic levels, mainly affected by natural condition and anthropogenic activities such as domestic sewage, industrial and non-point source pollution. Organic pollutants, fertilizer-born nutrients (mainly nitrogen and phosphorus) and heavy metals can reach water course through direct discharge, leaching or with eroded soil particles [50].

The trophic state of LLF in the dry season higher than flood season.The trophic state of floodplain affected by season. According to Junk and Bayley [51], floodplain are most productive during dry season. It could happen because in dry season, trophic status greatly influenced by the optimal primary productivity that supported by optimal light intensity and avaibility of nutrient. However, Junk [26] stated that in many river floodplains, the input of fertile sediments and dissolved nutrients carried by flooding was the main cause of the high productivity in many floodplain rivers.

High trophic state values of nutrients (TSI TP, TLI TP and TLI TN) affected by high concentration of these two nutrients. According to Richardson [18], a large proportion of phosphorus in freshwater occurs as organic phosphates and cellular constituents in the biota or is adsorbed to inorganic and dead particulate matter. Highly TP and TN in floodplain mainly composed by particulate form. It is shows from the comparing values between TP and orthophosphate as dissolved form, also between TN and dissolved nitrogen form i.e. nitrate and nitrite (Table 3). Noe and Hupp [52] stated that high TP and TN concentration caused by constituents entering the floodplain flowpath during flooding. The TP concentration of floodplain is large and it's caused mainly by particulate P fractionation. Meanwhile, high TN during flooding caused by the decreasing 6% of dissolved organic nitrogen (DON) and increasing 5% of particulate organic nitrogen (PON).

The area of channel plantation (CP) was the highest TSI values and this area also categorized highly polluted [27]. According to Dembkowski [53], runoff from agricultural fields may contain high concentration of phosphorus and nitrogen-based pesticides and fertilizers, contributing to eutrophication. This station has high concentration of nutrients i.e. phosphorus and nitrogen (Table 3).

In spite of the two-tailed t-test of TSI and TLI values showed that significant mean difference among stations in season, but considering to the clasification values criteria, all stations were in hyper-eutrophic state. Hence, we can use this two formulas eventhough Wu *et al.* [65] suggested to use TLI because simpler, faster and more accurate. On the other hand, several researchers [17-18] suggested to use TSI if TP as limitting factors, and use TLI if TN as limitting factors or nutrient balance.

Relationship between trophic state habitat and lenght-weight relationship (LWR) reported by Moutopoulos [66]. This study results showed that the "b" value from LWR were estimated for 3 species of fishes representing fishes floodplain group based on Welcomme [41] and also representing different food habit (*O. vittatus* and *H. temmincki* tend to herbivore, whereas the *C. striata* is carnivora [25,67-68]. The "b" values of most of fish samples were more than 3 mean that the fish becomes weighter and also showing the area offers good condition to these population [69-70]. The TSI values related to food avaibility for fish [63]. Food supply and sufficient space area throughout the year were probably contributing to the steady increase in fish weight and lenght [42-70].

The GSI of fish as one of reproductive indicators also can be used to represent influence of trophic state to gonadic growth of fish. GSI of fish is higher in eutrophic water than oligotrophic, it's may be a result of greater nutrient availability [71]. GSI values for *O. vittatus* each stations and seasons were high (2.53-6.81 % for male and 3.00-15.86% for female) eventhough still under GSI values for cultured *O. vittatus* (21.25±4.41%) [72]. GSI values for H. temmincki (0.28-3.33% for male and 1.30-10.43% for female), meanwhile other studies showed the GSI values 4.48% [73]. GSI values for C. striata for male (0.33-0.59%) higher than the GSI values from other studies (0.05-0.37%), meanwhile for female (0.21-2.73%) lower than GSI values from other studies (1.08-4.8%) [74].

20. Conclusions

Based on Carlson's TSI and TLI formula it was indicated that Lubuk Lampam in the hyper-eutrophic state. In tis research, those two methods can be used. The high trophic status of aquatic system gave positive effect to additional weight and GSI of fish.

Acknowledgement

Financial support was received from scholarship of Directorate General of Higher Education, Ministry of Education and Culture, Indonesia. We are grateful to Laboratory of Fisheries, and also Laboratory of chemical, biological and productivity of soil, Faculty of Agriculture, Sriwijaya University; Laboratory of Productivity and Environmental also Laboratory of Biology Departement of Fisheries Resources Management, Bogor Agricultural University; Research Institute for Inland Water Fisheries; and Laboratory of Agrochemicals Residues, Environmental Research Institute, Ministry of Agriculture, Indonesia.

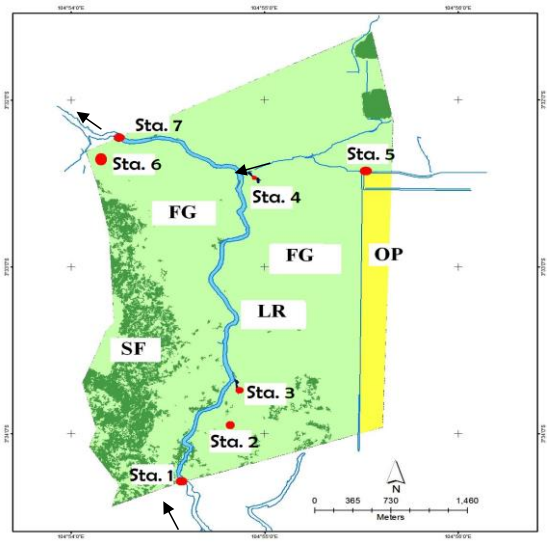
References

[1] Dodds, W.K. 2014. Eutrophication and trophic state in rivers and streams. Limnol. Oceanogr. 51 (1.2): 671-680.
[2] Dodds, W.K. 2007. Trophic state, eutrophication and nutrient criteria in streams.Trends in Ecology and Evolution. 22 (12): 669-676 , www.sciencedirect.com. doi:10.1016/j.tree.2007.07.010.
[3] Hua, C.H., Ming, H.W., Asit, M., Yan, L. Trophic state, natural organic matter content, and disinfection by-product formation potential of six drinking water reservoirs in the Pearl River Delta, China. Journal of Hydrology. 359 : 164-173. www.elsevier.com/locate/jhydrol. doi:10.1016/j.jhydrol.2008.06.024.
[4] Carey, C.C and Rydin, E. 2011. Lake trophic status can be determined by the depth distribution of sediment phosphorus. Limnol. Oceanogr. 56(6) 2051–2063. doi:10.4319/lo.2011.56.6.2051
[5] Nawrocka, J and Kobos, J. 2011. The trophic state of the Vistula Lagoon : an assessment based on selected biotic and abiotic parameters according to the water framework directive. Oceanologia.53(3): 881-894. http://www.iopan.gda.pl/oceanologia/doi:10.5697/oc.53-3.881
[6] Schaedel, A. 2011. Oregon DEQ harmful algal bloom (HAB) strategy, Appendix D. DEQ State of Oregon Department of Environmental Quality. p.8.
[7] Carlson, R.E. 1977. A trophic state index for lakes. Limnology and Oceanography. 22 (2) : 361-369.
[8] Rakocevic-Nedovic, J and Hollert H. 2005. Phytoplankton community and chlorophyll *a* as trophic state indices
of Lake Skadar (Montenegro, Balkan). Environ Sci & Pollut Res. 12(3)146–152. http://dx.doi.org/10.1065/espr2005.04.241
[9] Galvez-Cloutier, R and Sanchez, M. Trophic status evaluation for 154 Lakes in Quebec, Canada: monitoring and recommendations. Water Qual. Res. J. Canada. 42(4): 252-268.
[10] Murthi, G.P., Shivalingaiah, B.C., Leelaja, S.P., Hosmani. 2007. Trophic state index in conservation of lake ecosystems. Proceedings of Taal 2007 : The 12th World lake Conference. pp. 840-843.
[11] Elmaci, A., Ozengin, N., Teksoy, A., Topac, F.O., Baskaya, H.S. Evaluation of trophic state of lake Uluabat, Turkey. Journal of Environmental Biology. 30(5): 757-760. www. jeb.co.in.
[12] Molisani, M.M., de Sousa Barosso, H., Becker, H., Moreira, M.O.P., Hijo, C.A.G., de Monte, T.M., Vasconcellos, G.H. Trophic state, phytoplankton assemblages and limnological diagnosis of the Castanhão Reservoir, CE, Brazil. Acta Limnologica Brasiliensia. 22(1): 1-12. doi: 10.4322/actalb.02201001.
[13] Prasad, A.G.D and Siddaraju. 2012. Carlson's trophic state index for the assessment of trophic status of two Lakes in Mandya district. Advanced in Applied Science Research. 3(5): 2992-2996. www.pelagiaresearchlibrary.com.

[14] Rahmati, R., Pourgholam, R., Najafpour, S.H., Doudstdar, M. 2011. Trophic status of a Shallow Lake (North of Iran) based on the water quality and the phytoplankton community. World Applied Sciences Journal14 (special issue of food and environment).pp. 112-120
[15] Rahul, U., Arvind, P.K., Upadhyay, S.K. 2013. Assessment of lake water quality by using Palmer and Trophic State Index- a case study of Upper Lake, Bhopal, India. International Research Journal Environment Sciences. 2(5): 1-8. www.isca.in.
[16] Thomatou, A.A., Triantafyllidu, M., Chalkia, E., Kehayias, G., Konstantinou, I. Zacharias, I. 2013. Land use changes do not rapidly change the trophic state of a deep lake Amvrakia Lake, Greece. Journal of Environmental protection. 4: 426-434. http://www.scirp.org/journal/jep. doi:10.4236/jep.2013.45051.
[17] Sigua, G.C., Williams, M.J., Coleman, S.W., Starks, R. 2006. Nitrogen and phosphorus status of soils and trophic state of lakes associated with Forage-Based Beef Cattle operations in Florida. J. Environ. Qual. 35:240–252.
doi:10.2134/jeq2005.0246
[18] Richardson, J. 2010. Water Quality Report for Selected Lakes and Streams. Leon County Public Works. Division of Engineering Services., 2010. p. 278
[19] Yaoyang, X., Meiling, S., Xinqin, H. Qinghua, C. 2010. Temporal asynchrony of trophic status between mainstream and tributary bay within a giant dendritic reservoir: the role of local-scale regulators. Water Air Soil Pollut. p.14. DOI 10.1007/s11270-010-0705-5.
[20] Huibin, Y., Beidou, X., Jinyuan, J., Heaphy, M.J., Hailong, W., Dinglong, L. 2011. Environmental heterogeneity analysis, assessment of trophic state and source identification in Chaohu Lake, China. China, Environ Sci Pollut Res. 18:1333-1342. DOI 10.1007/s11356-011-0490-8.
[21] Burns, N., Bryer, G., Bowman, E. 2000. Protocols for monitoring trophic levels of New Zealand lakes and reservoir. Ministry for the environmen, Wellington, New Zealand. p.130.
[22] Meredith, A and Wilks, T. Canterbury high country lakes water quality monitoring programme : results of the third year monitoring 2007. Environment Canterbury, 2007,p.39.
[23] Al-Abbawy D.A.H. 2012. Assesment of trophic status for Shatt Al-Arab river using trophic state index (TSI). Journal of Basrah Researches (Sciences). 38 (3.A): 36–44.
[24] Chaurasia, S., Dwivedi, R., Karan, R. 2013. Water quality and trophic status of the River Sai at Raibareli, Uttar Pradesh, India. Int. J. Curr. Sci. 9 : E 15-18. www.currentsciencejournal.info
[25] Welcomme, R.L. 1985. River Fishes. FAO Tech. Bull. 262, Rome. p.330.
[26] Junk, W.J. 1996. Ecology of floodplains – a challenge for tropical limnology. In: Schiemer, F., Boland, K.T. (eds.), Perspectives in Tropical Limnology SPB Academic Publishing by Amsterdam, The Netherlands, 1996, p. 255.
[27] Jubaedah, D., Hariyadi, S., Muchsin, I., Kamal. M.M. 2014. Water Quality Index of Floodplain River Lubuk Lampam South Sumatera Indonesia. International Journal of Environmental Science and Development (IJESD). 6(4) : 252-258. DOI: 10.7763/IJESD.2015.V6.600.
[28] Husnah. 2008. Potential Threat to the Floodplain Ecosystem of Lempuing River, South Sumatera. In: Hartoto, D.I., Koeshendrajana, S., Kartamihardja, E.S., Utomo, A.D., Nasution Z. (eds.),Fisheries Ecology and Management of Lubuk Lampam Floodplain Musi River, South Sumatera, Research Institute for Inland Water Fisheries, Ministry of Marine and Fisheries Affairs, Palembang. pp.149-155
[29] APHA. 1998.Standar methods for the examination of water and wastewater. 18th edition, APHA, AWWA and WPCF
[30] Wenzhi, L., Quanfa, Z., Guihua, L. 2011. Effects of watershed land use and lake morphometry on the trophic state of Chinese lakes: implications for eutrophication control. Clean-soil, air, water. 39(1): 35-42. www.clean-journal.com. 10.1002/clen.201000052.
[31] Burns, N., McIntosh, J., Scholes, P. 2005. Strategies for managing the lakes of the Rotorua District, New Zealand. Lake and Reserv. Manage. 21(1) : 61-72
[32] Hamilton, D and Parparov, A. 2010. Comparative assessment of water quality with the Trophic Level Index and the Delphi Method in Lakes Rotoiti and Rotorua, NewZealand. Water Qual. Res. J. Can. 45(4): 479-489.
[33] Otago Regional Council. 2005. Lake Waipori & Lake Waihola Trophic Level Status Report p.53.
[34] Castellano, S. 2013. A project Report in partial fulfillment of the requerements for the degree of Master of Sciences. Departement of Civil and Environmental Engineering, Brigham Young University.p.164
[35] Hughes, P.E. 1993. Water-Resources investigation report 91-4076.
[36] Welling, M.L., Munzenmaier, M., Waldmer, E., Bourne, J., Sutherland, S.R., Wardius, K., Magruder, C. 2001.Trophic State and Chlorophyll in the Milwauke, Wisconsin Harbor and surrounding nearshore waters. Water quality Reseach Departement Milwaukee Metropolitan Sewerage District. p 38.
[37] Sharma, M.P., Kumar, A., Rajvanshi, S. 2010. Assessment of Trophic State of Lakes: A Case of Mansi Ganga Lake in India. Hydro Nepal. 6:65-71.

[38] Fuller, L.M., Jodoin, R.S., Minnerick, R.J. 2011. U.S. Geological Survey Scientific Investigation Report 2011-5007.
[39] Chaves, F.I.B., Lima, P.F., Leitão, R.C., Paulino, W.D., Santaella, S.T. 2013. Influence of rainfall on the trophic status of a Brazilian semiarid reservoir. Acta Scientrum Biological Sciences, Maringá. 35(4): 505-511. http://www.uem.br/acta. Doi: 10.4025/actascibiolsci.v35i4.18261
[40] Santos, J.C.N., de Andeade, E.M., Neto, J.R.A., Meureles, A.C.M., Palacio HAQ. 2014. Land use and trophic state dynamics in a tropical semi-arid reservoir. Revista Ciência Agronômica. 45(1): 35-44. www.ccarevista.ufc.br.
[41] Welcomme, R.L. 1979. Fisheries Ecology of Floodplain Rivers, Longman Inc., New York. p.317.
[42] Montchowui, E., Kogbeto, M., Laleye, P. 2009. Weight–length relationships for commercial fish species caught in
Lake Hlan in Benin (West Africa). Int. J. Biol. Chem. Sci. 3(3): 612-616. http://www.ajol.info.
[43] Gerami, M.H., Abdollahi, D., Patimar, R. 2013. Length-weight, length-length relationship and condition factor of *Garra rufa* in Cholvar River of Iran. World Journal of Fish and Marine Sciences. 5(4): 358-361. DOI: 10.5829/idosi.wjfms.2013.05.04.7371.
[44] Ezekiel, E.N. and Abowei, J.F.N. 2013. Length-Weight Relationship and Condition Factor of Heterotis niloticus from Amassoma flood plain, Niger Delta, Nigeria. Applied Science Report. 4(1): 164-172. www.pscipub.com/ASR.
[45] Effendie, M.I.. 1979. Metoda Biologi Perikanan, Yayasan Dewi Sri, Bogor.p.112.
[46] Effendie, M.I.. 1997. Biologi Perikanan, Yayasan Nusatama, Yogyakarta.p.163.
[47] Mondal, D.K. and Kaviraj, A. 2010. Feeding and reproductive biology of Indian Shad *Gudusia chapra* in two floodplain lakes of India. Electronic Journal of Biology. 6(4): 98-102.
[48] Venterink, H.O., Wiegmab, F., Van der lee, G.E.M., Vermaat, J.E. 2003. Role of active floodplains for nutrinet retention in the river Rhine. J. Environ. Qual. 32 : 1430-1435
[49] Graham, R and Harris, J.H. 2005. Floodplain inundation and fish dynamics in the Murray-Darling Basin. Current concepts and future research : a scoping study. CRC for Freshwater Ecology. p.56
[50] Lair, G.J., Zehetner, F., Fiebig, M., Gerzabek, M.H., Van Gestel, C.A.M., Hein, T., Hohensinner, S., Hsu, P., Jones, K.C., Jordan, G., Koelmans, A.A., Poot, A., Slijkerman, D.M.E., Totsche, K.U., Bondar-Kunze, E., Barth, J.A.C. 2009. How do long-term development and periodical changes of river–floodplain systems affect the fate of contaminants? Results from European rivers. Environmental Pollution. 157:3336-3346. www.elsevier.com/locate/envpol. doi:10.1016/j.envpol.2009.06.004.
[51] Junk, W.J. and Bayley, P.B. 2007. The Scope of the Flood Pulse Concept Regarding Riverine Fish and Fisheries, Given Geographic and Man-Made Differences between Systems. Proceeding of the American Society Syposiun 49, American Fisheries Society.p.587.
[52] Noe, G.B. and Hupp, C.R. 2007. Seasonal variation in nutrient retention during inundation of a short-hydroperiod floodplain. River Research and Applications. 23: 1088-1101. www.interscience.wiley.com. DOI: 10.1002/rra.1035.
[53] Dembkowski, D.J. 2011. Fish biodiversity in floodplain lakes of the Mississipi aluvial valey. Master Sciences Thesis, Depaartement of Wildlife, Fisheries and Aquaculture, Mississippi State University, United States. p.82
[54] Eisler, R. 1990. Paraquat Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. Biological Report. 85 (1.22). U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland.p.38.
[55] Adak, A., Pal, A., Bandyopadhyay, M. 2005. Spectrophotometric determination of anionic surfactants in wastewater using acridine orange. Indian Journal of Chemicl Technology. 12: 145-148
[56] WHO. 2005. Glyphosate and AMPA in drinking waters. http://www.who.int/water" sanitationhealth.p.19.
[57] Davis, A., Lewis, S., Bainbridge, Z., Brodie, J., Shannon, E. 2008. Pesticide residues in waterways of the lower Burdekin region : challenges in ecotoxicological interpretation of monitoring data. Australian Journal of Ecotoxicology. 14:89-108
[58] Singh, R.P., Ibrahim, M.H., Esa, N., Illiyana, M.S. 2010. Composting of waste from palm oil mill: a sustainable waste management practice. Rev. Environ. Sci. Biotechnol. 9: 331-344. DOI 10.1007/s11157-010-9199-2
[59] Ghoochani, M., Shekoohiyan, S., Mahvi, A.H., Haibati, B., Norouzi, M. 2011. Determination of Detergent in Tehran Ground and Surface Water. American-Eurasian Agric. & Environ. Sci. 10 (3) 464-469.
[60] Coupe, R.H., Kalkhoff, S.J., Capel, P.D., Gregorie, C. 2011. Fate and transport of glyphosate and aminomethylphosphonic acid in surface waters of agricultural basins. Pest Management Sciences wileyonlinelibrary.com) DOI 10.1002/ps.2212.

[61] Shia, C., Yabu, M., Tran, K.V., Young, M.S. 2013. Improved resolution for paraquat and diquat : drinking water analysis using the CORTECS UPLC HLIC column. Waters, the sciences of what's posible. http://www.water.com. p.8.
[62] Kumar, R.T., Sampson, A., Dorathy, E., Wokoma, I., Ablorh, M.A. 2013. Study on environmentl impact on oil and gas activities in Ghana- Analysis by graphical approaches using Matlab. International Journal of Engineering Trends and Technology. 4(3): 344-348. http://www.internationaljournalssrg.org
[63] Oliver, D.P., Anderson, J.S., Davis, A., Lewis, S. Brodie, J., Kookana, R. 2014. Banded applications are highly effective in minimising herbicide migration from furrow-irrigated sugar cane. Science of the Total Environment. 466–467: 841–848 .www.elsevier.com/locate/scitotenv.
[64] Indonesia Goverment Regulation. 2001. Regarding Water Quality Management and Water Pollution Control, No. 82/2001.
[65] Wu, Z., Jie, R., Chen, S., Xin, Y., Liang, Y. 2012. Spatial-Time Comparative Analysis and Evaluation of Eutrophication Level of Nansi Lake. Asia Pacific Conference on Environmental Science and Technology, Advances in Biomedical Engineering. 6: 485-491.
[66] Moutopoulos, D.K., Koukou, K., Vavarouta, V., Ramfos, A., Katselis, G. 2011. Investigation of Length-Weight Relationships for 10 commercial fish species as a possible trophic state index of Coastal Lagoons. ACTA ADRIAT. 52(2): 261 – 268.
[67] Buchar, T., Handayani, T., Najamuddin, A. 2007. Ichtio-fauna danau Batu, Kalimantan Tengah. Journal of Tropical Fisheries. 2 (2): 188-200.
[68] Swingle, H.S and Allison, R. 1971. The inland fisheries progress 1970, Project report : AID/csd-2770, USOM/Thailand PIOT 493-180-3-80413, International Center for Aquaculture Auburn University, Auburn, Alabama,
[69] Akombo, P.M., Akange, E.T., Adikwu, I.A., Araoye, P.A. 2014. Length-weight relationship, condition factor and feeding habits of *Synodontis schall* (Bloch and Schneider, 1801) In river Benue at Makurdi, Nigeria. International Journal of Fisheries and Aquatic Studies. 1(3): 42-48. www.fisheriesjournal.com.
[70] Ikongbeh, O.A., Ogbe, F.G., Solomon, G. 2012. Length-weight relationship and condition factor of *Bagrus docmac* from Lake Akata, Benue state, Nigeria. Journal of Animal&Plant Sciences. 15(3): 2267-2274. http://www.m.elewa.org/JAPS
[71] Writer, J.H., Barber, L.B., Brown, G.K., Taylor, H.E., Kiesling, R.L., Ferrey, M.L., Jahns, N.D. Bartel, S.E. 2010. Anthropogenic tracers, endocrine disrupting chemicals, and endocrine disruption in Minnesota lakes. Science of the Total Environment. 409:100-111. www.elsevi e r.com/locate/scitotenv. doi:10.1016/j.scitotenv.2010.07.018
[72] Subagja, J., R. Gustino, Winarlin. 2007. Teknologi reproduksi ikan nilem (*Osteochillus hasselti* C.V.) : pematangan ginad, penanganan telur dan penyediaan calon induk. Di dalam Seminar Nasional Hari Pangan Sedunia XXVII : Dukungan Teknologi untuk Meningkatkan Produk Pangan Hewani dalam Rangka Pemenuhan Gizi Masyarakat; 2007 November 2001, Bogor, Indonsia. Badan Penelitian dan Pengembangan Pertanian Kementerian Pertanian. 187-194.
[73] Rahman, Y., Setyawati, T.T., Yanti, A.H. 2013. Karakteristik populasi ikan biawan (*Helostoma temminckii* Cuvier) di Danau Kelubi Kecamatan Tayan Hilir. Journal Protobiont. 2(2): 80-86.
[73] Makmur, S., Rahardjo, M.F., Sukimin, S. 2003. Biologi reproduksi ikan gabus (*Channa striata* Bloch) di daerah banjiran sungai Musi Sumatera Selatan. Jurnal Iktiologi Indonesia. 3(2) : 57-62


Sta. 7
Sta. 6
Sta. 5
Sta. 4
FG
FG
OP
LR
SF
Sta. 3
Sta. 2
Sta. 1
N
0
365
730
1,460
Meters

Sampling station
Lempuing Rivers
Boundary
Direction of current flow

Map Source :

13. Digital map of Indonesia earth surface, scale 1: 50.000, 2010
14. Worldview, 2013
15. On screen digitation, 2013
16. Sampling, 2013

Figure 1. Study area and sampling sites (stations) : Kapak Hulu (Sta. 1), flooded grassland 1 (Sta. 2), Suak Buayo (Sta. 3), Lebung Proyek (Sta. 4), channels of oil palm plantations (Sta. 5), flooded grassland 2 (Sta. 6), and Lempuing Hilir (Sta. 7), Flooded grassland (FG), flooded forest (SF), Lempuing river (LR), and oil palm plantation (OP).

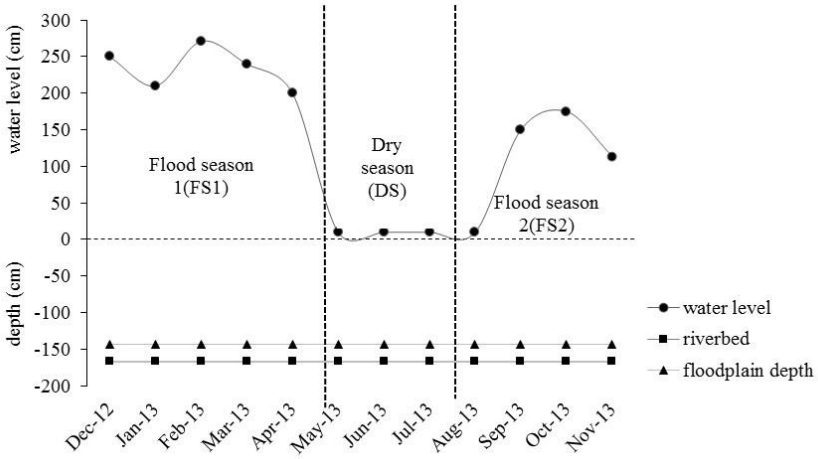


Figure 2. Water level fluctuation and seasonal pattern

70

70

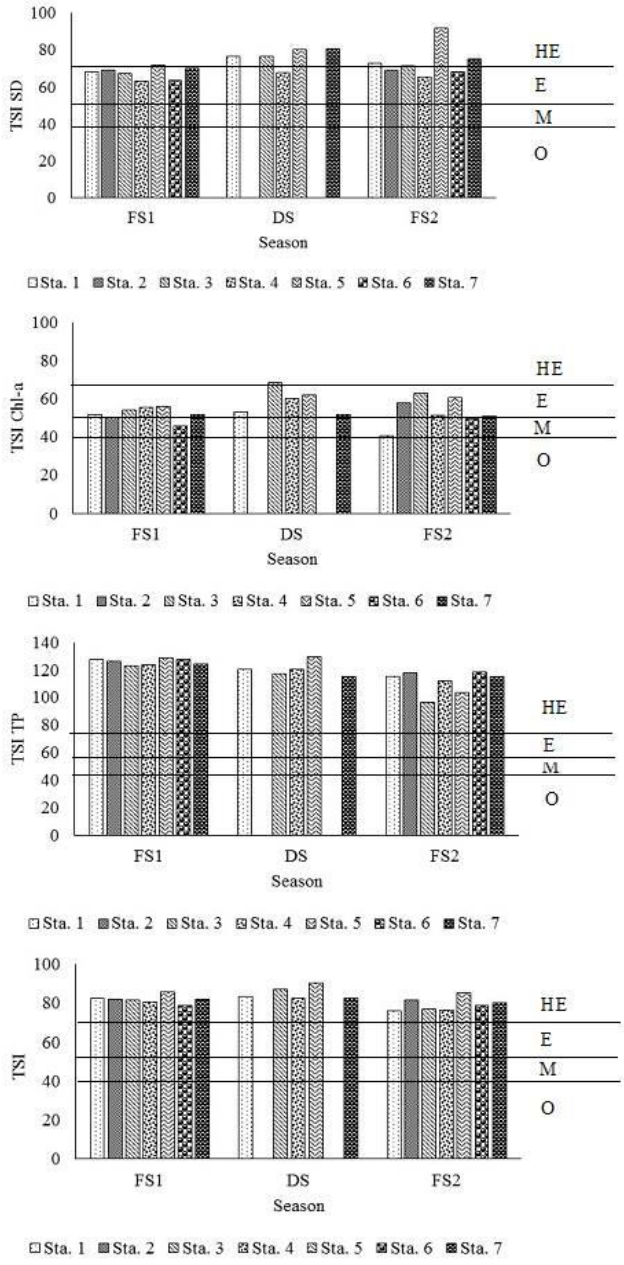


Figure 3. TSI values in each stations and season; trophic levels : HE (Hyper-eutrophic), E (Eutrophic), M (Mesotrophic), O (Oligotrophic)

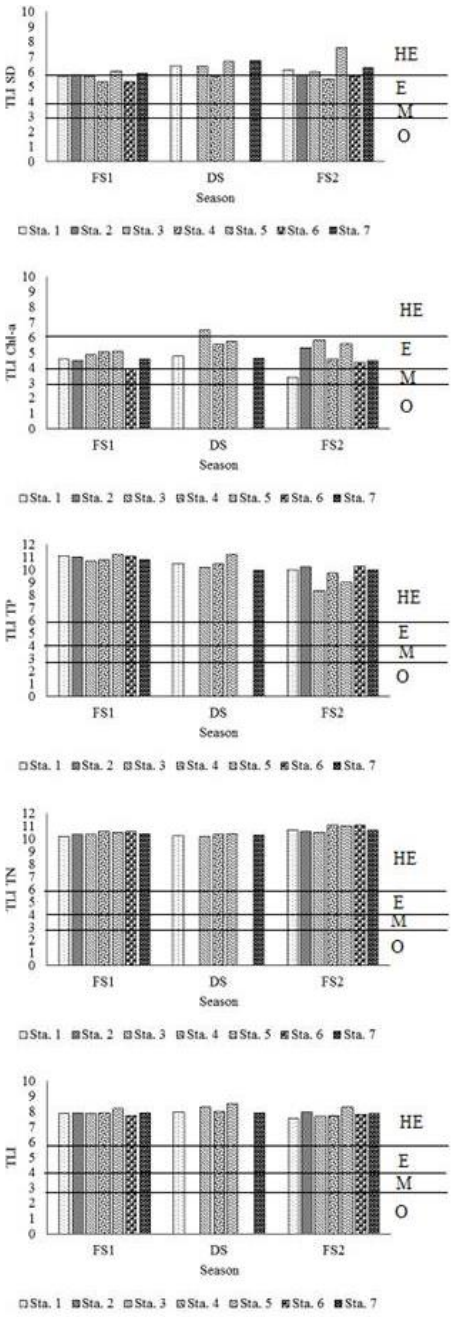


Figure 4. TLI values in each stations and clusters

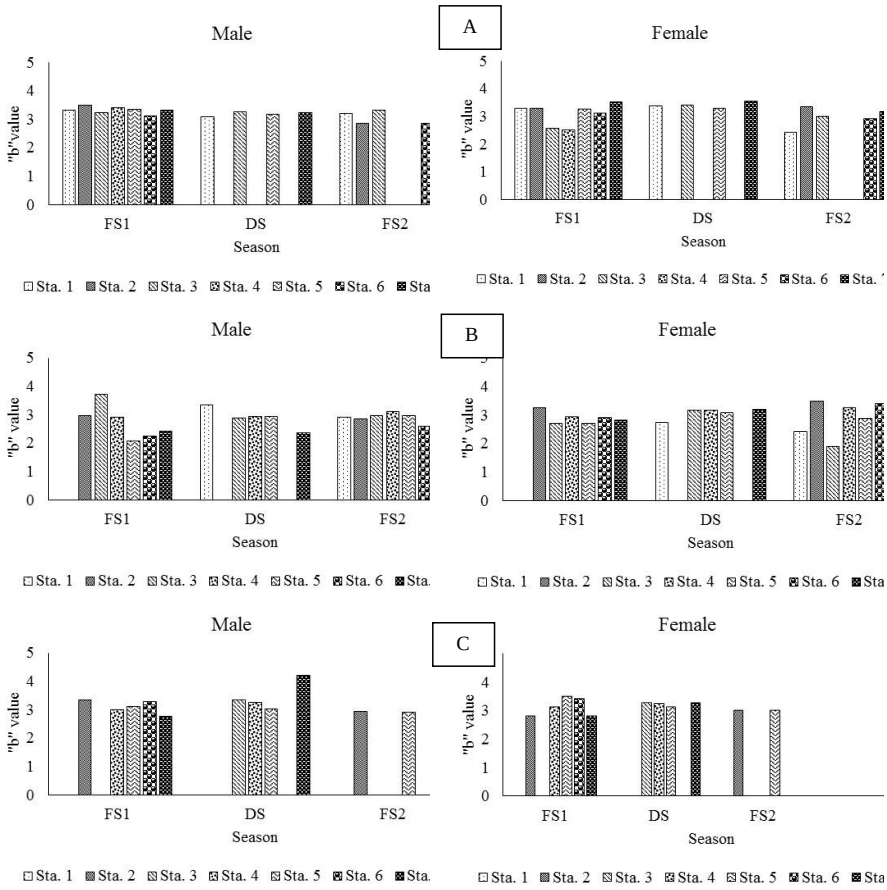


Figure 5. "b" values from fish lenght-weight relationship : (A) *O. vittatus,* (B) *H. temminckii,* and (C) *C. Striata*

C

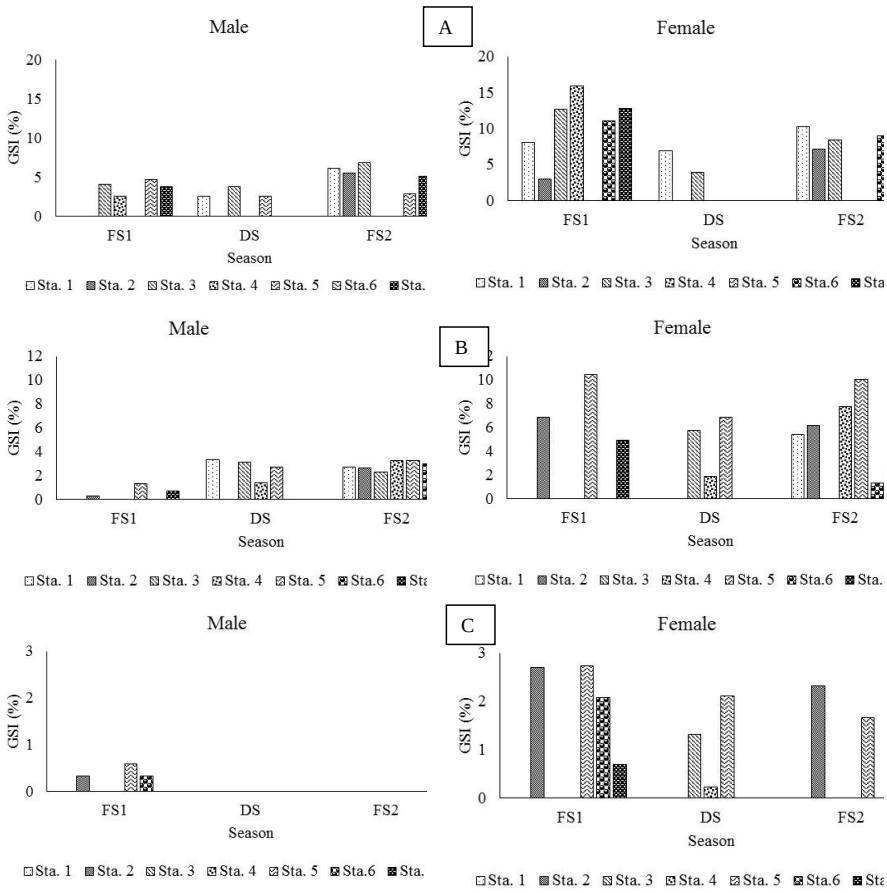


Figure 6. GSI : (A) *O. vittatus, (*B) *H. temminckii*, and (C) *C. Striata*

Table 1. TSI and TLI Classification values

Trophic state	TSI level*)	TLI level**)
Oligotrophic (O)	< 40	< 3.0
Mesotrophic (M)	40< TSI ≤50	3.0< TSI ≤4.0
Eutrophic (E)	50<TSI≤70	4.0<TSI≤6.0
Hyper-eutrophic (HE)	>70	>6.0

*) TSI Level adopted and modified from some references [6, 9, 17, 30, 34-40]
**) TLI level based on Castellano [34]

Table 2. Ratio TN : TP (mol)

Station	TN/TP (mol/mol)		
	Flood season 1	Dry season	Flood season 2
Sta. 1	16	27	56
Sta. 2	19	-	43
Sta. 3	25	33	176
Sta. 4	28	30	90
Sta. 5	19	17	155
Sta. 6	22	-	58
Sta. 7	24	42	56

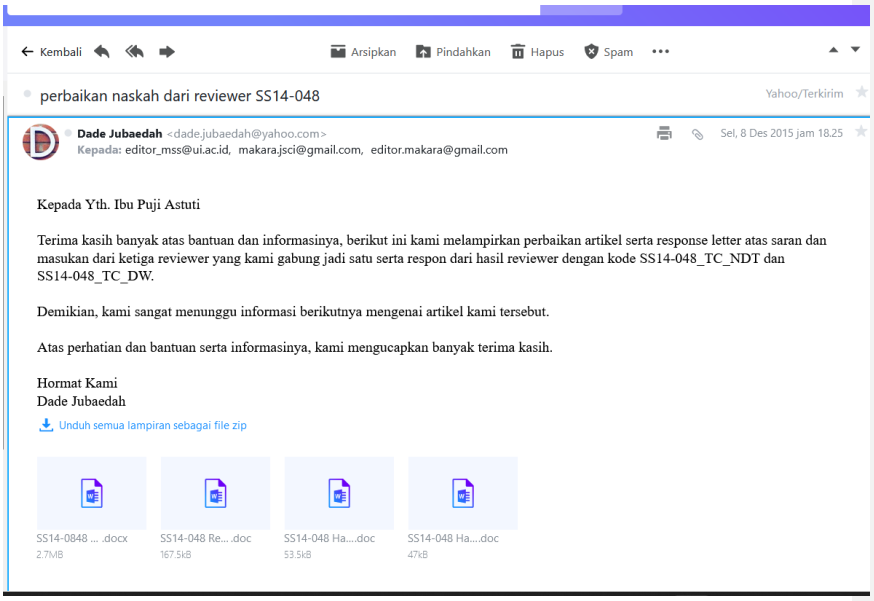
- : no observation at dry season

Table 3. Mean of concentration of TN, TP, nitrite, nitrate and orthophosphate (mg/L)

Station	TN			TP			Nitrite	Nitrate	Ortho-phosphate
	FS1	DS	FS2	FS1	DS	FS2			
Sta. 1	39.92	38.74	56.03	5.40	3.23	2.20	0.30	2.67	0.08
Sta. 2	42.02	-	50.43	4.86	-	2.60	0.02	1.96	0.11
Sta. 3	43.14	37.70	47.62	3.77	2.52	0.60	0.25	3.07	0.07
Sta. 4	**51.54**	42.64	**72.84**	4.04	3.33	1.80	0.20	2.76	0.10
Sta. 5	49.30	**45.22**	70.03	**5.80**	**5.85**	1.00	**0.30**	**4.53**	**0.16**
Sta. 6	50.98	-	**72.84**	5.21	-	**2.80**	0.02	1.70	0.07
Sta. 7	43.70	40.79	56.03	4.08	2.17	2.20	0.17	2.88	0.12

Season : flood season 1 (FS1), dry season (DS), and flood season 2 (FS2)
Bold characters are the highest value
- : no observation at dry season

5. Bukti Respon Letter (8 Desember 2015)



Journal : Makara Journal of Science

Manuscript ID : SS14-048

Title: **Trophic State of Floodplain River Lubuk Lampam South Sumatera Indonesia**

There are some following issues that needs to be addressed:

Reviewer 1 SS14-048 TC-NDT

Reviewer's Comments	Author's Comments
1. Review of english grammar i.e. a. line 11 : show b. line 12 : the c. line 13 : sample d. line 35 : variety e. Line 43 : shown f. Line 49 : flooding originates g. Line 56 : area h. Line 133 : shows	1. Had been replaced as suggested by reviewers, i.e. a. showed b. those c. samples d. varities e. show f. flood originate g. areas h. were shown i. had been added

i. Line 154: addition of “were” j. Line 154 : shows k. Line 171 : caused l. Line 210 : add it iwas m. Line 211 : these	j. showed k. cause l. had been added m. those
2. Review of writing mistake, i.e. a. Line 12 : hypereutrophic b. Line 20 : perubahan c. Line 23 : contoh air d. Line 24 : contoh e. Line 24-25 : Berdasarkan dua formula...dst f. Line 25 : juga g. Line 26 h. Line 35 : on ranging i. Line 36 j. Line 38 : in the next development k. Line 49 : local rainfal and tides l. Line 49 : changing m. Line 52 : over n. Line 155 : it’s o. Line 156 : otherwise p. Line 164 : coarses q. Line 168 : Which is r. Line 169 : Eventhough s. Line 170 : that be t. Line 178 : large u. Line 178 : it’s v. Line 210 : on the hypereutrophic w. Line 210 : the case of x. Line 211 : addition of	2. Had been corrected as suggested by reviewers, i.e. a. Hyper-eutrophic b. perubahan tingkat c. kualitas air d. had been deleted e. Hasil menunjukkan bahwa berdasarkan dua metode f. had been deleted g. penambahan kata “adanya” h. had been deleted i. had been added : methods j. had been replaced : later k. local rainfall, l. fluctuation m. large n. it is o. moreover p. course q. had been deleted r. However s. Had been deleted t. high u. it is v. in hypereutrophic w. this research x. additional
3. Additional data, i.e : a. Line 26-27	3. Had been completed as suggested by reviewers, i.e. : a. ditambah angka untuk menunjukkan nilai b dan indeks

	kematangan gonad (gonado somatic index)

Reviewer 2 SS14-048 TC-AS

Reviewer's Comments	Author's Comments
1. Writing mistakes : a. Line 51 b. Line 164 : Water coarses c. Line 228 : Limol 2. Line 186-188	1. Had been corrected as suggested by reviewers, i.e. a. seasonal b. water course c. Limnol 2. Line 186-188 : had been deleted

Reviewer 3 : Reviewer 2 SS14-048 TC-DW

Reviewer's Comments	Author's Comments
1. Judul : **Trophic Stateus of Lubuk Lampam Floodplain~~River~~, ~~Lubuk Lampam~~ South Sumatera, Indonesia** 2. Abstract ~~Trophic state of~~ Lubuk Lampam floodplain ecosystem ~~river wa~~is naturally affected by the ~~natural~~fluctuation ~~change~~ of the water surface~~level fluctuation~~. Thise ecosystem also receives anthropogenic ~~substans~~substance~~tial load of~~such as nutrient and other chemicals~~resulting from the anthropogenic activities,~~ especially from oil palm plantation and it's industrial processing activities. The main objective of this research was to determine the trophic stateus of the floodplain ~~river area~~ using ~~Carlson's t~~TrophicSstate~~i~~Index (TSI) of Carlson and ~~t~~Trophic~~l~~Level~~i~~Index (TLI). The water quality and the fish samples were collected and analyzed from 7 stations ~~that~~ representing various habitat types of	1. Judul **Trophic Status of Lubuk Lampam Floodplain South Sumatera, Indonesia** 2. Abstrak Lubuk Lampam floodplain ecosystem river is naturally affected by the fluctuation of the water surface. This ecosystem also receives anthropogenic substances such as nutrient and other chemicals, especially from oil palm plantation and it's industrial processing activities. The main objective of this research was to determine the trophic status of the floodplain using Trophic State Index (TSI) of Carlson and Trophic Level Index (TLI). The water quality and the fish samples were collected and analyzed from 7 stations representing various habitat types of the floodplain. The results based on the two methods show that, the trophic status of Lubuk Lampam was hyper-eutrophic (very nutrient-rich). The fertility indication was also

habitat ofthe floodplain. The resultsshow that based on the two methods show that, the trophic stateus of LubukLampam wereas hypereutrophic (very nutrient-rich). Theis fertility indication trophic status was also supported by the high increase of the body weightsubstantial additional weight and the high gonado somatic index (GSI) of the studied fishes sampel.

Key words : floodplain rivers, trophic statuse, Lubuk Lampam

3. Pendahuluan :
   a. Alinea 1

There are variety of many methods used in assessing the trophic state of water bodies, on ranging from single to multi parameters [1-7]. The most classical and commonly used was introduced by Carlson [7-16], i.e. the trophic state index (TSI) in which the calculation is built by composed of total phosphorus, chlorophyll-a, and water transparency. Later, the TSI index has beenwas modified by adding total Nitrogen into the calculation [16-20]. In the next development, the estimation ofn aquatic trophic state was improved by the trophic level index (TLI). This index is applied by adding the value of total P to the previous index [21-22].

   b. Alinea 2

Both Carlson's TSI and TLI are applicable in determining the trophic status on stagnant waters including lakes and reservoirs. However, Carlson [7] stated that TSI was also appropriate to be used infor flowing waters including streamsandriverinehabitats. Some studies showedn the applicability of TSI in dynamic waters (23-24).

   c. Alinea 3

In comparison with lakes and rivers, water body in athe floodplain habitats areis characterized by both lotic and lentic

supported by the high increase of the body weight ("b" value more than 3) and the high gonado somatic index (GSI) of the studied fishes, i.e. *Osteochillus vittatus* 2.53-6.81% % (male) and 3.00-15.86% (female); *Helostoma temminckii* 0.28-3.33% (male) and 1.30-10.43% (female); *Channa striata* 0.33-0.59% (male) and 0.21-2.73% (female).

Key words : floodplain, trophic status, Lubuk Lampam

3. Pendahuluan :
   a. Alinea 1

There are many methods used in assessing the trophic state of water bodies from single to multi parameters [1-7]. The most classical and commonly methods used was introduced by Carlson [7-16], i.e. the trophic state index (TSI) in which the calculation composed of total phosphorus, chlorophyll-a, and water transparency. Later, the TSI index was modified by adding total Nitrogen into the calculation such as trophic level index (TLI) [16-22].

   b. Alinea 2

Both Carlson's TSI and TLI are applicable in determining the trophic status on stagnant waters including lakes and reservoirs. However, Carlson [7] stated that TSI was also appropriate to be used for flowing waters including riverine. Some studies showed the applicability of TSI in dynamic waters (23-24).

   c. Alinea 3 sudh diperbaiki :

In comparison with lakes and rivers, water body in a floodplain habitats are characterized by both lotic and lentic

d. Alinea 4 Since flooding originates from three sources, i.e. overspill from the river channels, local rainfall and tides, the changing of these sources will cause the changing of the floodplain water qualities and later will ~~influence~~affect the trophic status of the floodplain. According to Welcomme [25], the great fluctuation in water level cause a seasonal cycle of flood and drought over much of the area.	d. Alinea 4 Since floods originate from three sources, i.e. overspill from the river channels, local rainfall, and tides, the fluctuation of these sources will cause the changing of the floodplain water qualities and later will affect the trophic status of the floodplain. According to Welcomme [25], the great fluctuation in water level cause a seasonal cycle of flood and drought over large of the area.
e. Alinea 5 Lubuk Lampam is one of the important floodplain~~s area~~ situated in ~~district of~~ Ogan Komering Ilir district. The main river ~~of~~in the~~is~~ area is Lempuing river, one of Komering River tributaries. This area is ~~one of~~a natural floodplain that is important for ecological balance. Meanwhile, this area is also important for local economic growth especially from fisheries and agricultural activities [27]. The goverment has determined several sites within the area ~~to be~~as fishery~~ies~~ reserves, ~~i.e.~~such as Lebung Proyek, Suak Buayo and Kapak Hulu as shown in Figure 1. The potential threat to this floodplain is ~~identified from~~ the land~~scape changes~~convertion, such as deforestation and land clearance for agriculture i.e. oil palm plantation and industrial processing. Those activities~~are influenced~~affect the water quality deriving from leaching of pesticide, fertilizer and other agrochemicals [28].	e. Alinea 5 Lubuk Lampam is one of the important floodplain situated in Ogan Komering Ilir district. The main river in this area is Lempuing river, one of Komering River tributaries. This area is a natural floodplain that is important for ecological balance. Meanwhile, this area is also important for local economic growth especially from fisheries and agricultural activities [27]. The goverment has determined several sites within the area as fishery reserves, such as Lebung Proyek, Suak Buayo and Kapak Hulu as shown in Figure 1. The potential threat to this floodplain is the land convertion, such as deforestation and land clearance for agriculture i.e. oil palm plantation and industrial processing. Those activities affect the water quality deriving from leaching of pesticide, fertilizer and other agrochemicals [28].
f. Alinea 6 There is limited information about trophic state o~~f~~f Lubuk Lampam Floodplain (LLF). This study, therefore, is aimed to ~~asses~~ reveal the trophic status of this floodplain in relation to~~with~~ water level fluctuation and anthropogenic substances mainly from oil palm plantation and its industrial processing.	f. Alinea 6 There is limitted information about trophic state of Lubuk Lampam Floodplain (LLF). This study, therefore, is aimed to reveal the trophic status of this floodplain in relation to water level fluctuation and anthropogenic substances mainly from oil palm plantation and its industrial processing.
4. Material and Methods :	

a. Penulisan materials	
b. Alinea 1 Seven sampling sites were set up ~~located~~ in the upstream, inside and downstream of LLF (Fig. 1), i.e. 1) upper course main river Kapak Hulu (KH), 2) flooded grassland LK1, 3) natural floodplain pools Suak Buayo (SB), 4) man-made floodplain pools Lebung Proyek (LP), 5) channels of oil palm plantation (CP), 6) flooded grassland LK2, 7) downstream Lempuing Hilir (LH). Sampling was done monthly at all sites ~~but in~~ except for the flooded grassland (LK1 and LK2) ~~were took place~~ only during the flood season.	4. Material and Methods a. Penulisan sudah diperbaiki menjadi material and methods b. Alinea 1 Seven sampling sites were set up in the upstream, inside and downstream of LLF (Figure 1), i.e. 1) upper course main river Kapak Hulu (station 1), 2) flooded grassland 1 (station 2), 3) natural floodplain pools Suak Buayo (station 3), 4) man-made floodplain pools Lebung Proyek (station 4), 5) channels of oil palm plantation (station 5), 6) Flooded grassland 2 (station 6), 7) downstream Lempuing Hilir (station 7). Sampling was done monthly at all sites except for the flooded grassland (station 1 and station 6) only during flood season.
c. Alinea 2 Fish ~~S~~sampling and water quality checking were conducted from December 2012 to November 2013 ~~covering water quality (the whole period with monthly interval)~~, while the antrophogenic substances (detergent, herbicide, and oil and grease) were sampled~~these parameters were taken~~ only during the flood~~ing~~, highest water level, and dry season ~~period)~~. The ~~W~~water samples were collected, preserved, kept cooled at 4˚C, and analy~~s~~zed based on standard methods [29]. Measurement on total nitrogen (TN) and total phosphorus (TP) were performed by using spectrophotometric analy~~s~~zer. Chlorophyll-a (Chl-a) was collected, preserved with $MgCO_3$ and determined using spectrophotometric method~~s~~. Oil and grease was analy~~s~~zed using gravimetric method~~s~~, detergent was analy~~s~~zed using spektrophotometric analyzer, and herbicide using gas chromatography.	c. Alinea 2 Fish sampling and water quality checking were conducted from December 2012 to November 2013, while the antrophogenic substances (detergent, herbicide, and oil and grease) were sampled only during the flooding, highest water level, and dry season. The water samples were collected, preserved, kept cooled at 4ºC, and analyzed based on standard methods [29]. Measurement on total nitrogen (TN) and total phosphorus (TP) were performed by using spectrophotometric analyzer. Chlorophyll-a (Chl-a) was collected, preserved with $MgCO_3$ and determined using spectrophotometric method. Oil and grease was analyzed using gravimetric method, detergent was analyzed using spektrophotometric analyzer, and herbicide using gas chromatography.
d. Alinea 3 Trophic state of Lubuk Lampam wa~~i~~s calculated by using the Carlson's TSI value [7, 11, 30]. The TSI formula is:	d. Alinea 3 Trophic state of Lubuk Lampam was calculated by using the Carlson's TSI value [7, 11, 30]. The TSI formula were:
Secchi disk	Maksudnya adalah kedalaman secchi disk, sudah ditambahkan : Secchi disk depth
e. Alinea 4	

The classification values based on TSI and TLI are shownned in Table 1.Trophic state index bBoth TSI and TLI were analyszed based on among stations and season. The DifferenceMmean of TSI and TLI was tested by a t-test at the 0.05 significance level.	e. Alinea 4 Sudah disesuaikan bahwa tabel meliputi TSI dan TLI The classification values based on TSI and TLI are shown in Table 1. Both TSI and TLI were analyzed based on stations and season. The mean of TSI and TLI was tested by t-test at the 0.05 significance level.
f. Alinea 5 In this study, 3 species of fishes i.e. *Osteochillus hasselti* (n=805), *Helostoma temminckii* (n=793) and *Channa striata* (n=397) were caught in Lubuk Lampam during study. The Ssamples weretaken collected by fixedusing gillnet (0.5. 0.75, 1.0, 1.5, 2.0, 2.5, 3.0- mm mesh size) and portable traps. Then the Ssamples were measured offor their total lenghtlength (TL) and total wet weight for each species.	f. Alinea 5 Nama spesies sudah diganti pada keseluruhan bagian artikel kecuali pada daftar pustaka dari referensi yang aslinya masih mencantumkan nama spesies yang lama In this study, 3 species of fishes i.e. *Osteochillus vittatus* (n=805), *Helostoma temminckii* (n=793) and *Channa striata* (n=397) were caught in Lubuk Lampam. The samples were collected by using gillnet (0.5. 0.75, 1.0, 1.5, 2.0, 2.5, 3.0- mm mesh size) and portable traps. Then the samples were measured for their total length (TL) and total wet weight.
g. Alinea 6 The length of the fish was measured to the nearest 0.5 mm, and the weight to the nearest of 0.01 mg. The lenghtlength-weight relationship (LWR), $W=aL^b$ was converted to logarithmic expression: log W = Llog a + b log L. In this formula W is weight in gram and L is total lenghtlengthof fish in mm. The "a" and "b" parameters were determined according to the power regression model. The "b" value for each species was tested by a t-test at the0.05 significance level to verify if it was significantly different from 3 [41-44].	g. Alinea 6 The length of the fish was measured to the nearest 0.5 mm, and the weight to the nearest of 0.01 mg. The length-weight relationship (LWR), $W=aL^b$ was converted to logarithmic expression : log W = log a + b log L. In this formula W is weight in gram and L is total length in mm. The "a" and "b" parameters were determined according to the power regression model. The "b" value for each species was tested by t-test at 0.05 significance level to verify if it was significantly different from 3 [41-44]
h. Alinea 7 The Ssex determination of the fish samples was determined examined bythrough macroscopic gonad morphology examinationafter dissection (45). Later,	h. Alinea 7 The sex of the fish samples was determined through macroscopic gonad morphology examination (45). Later, the gonads were weighed and subsequently preserved in Gilson solution. Seasonal changes in gonad mass for both sexes were determined by

the Ggonads were ~~separated from fish body and~~ weighed and subsequently preserved in Gilson solution. Seasonal changes in gonad mass for both sexes wasere determined by using ~~the~~ gonado somatic index (GSI). The GSI is calculated as GSI (%) = 100 x (weight of gonad / weight of fish) [41, 46-47].	using gonado somatic index (GSI). The GSI is calculated as GSI (%) = 100 x (weight of gonad / weight of fish) [41, 46-47].
5. Results	5. Results
a. Alinea 1	a. Alinea 1
Cluster analysis of water level generated a dendrogam as shown in Figure 2 grouping the 12 months of research into four clusters. The Wwater level values were similar ~~nearly the same in~~at the beginning of low water level (LWL) and at the beginning of flooding hence grouped them ~~, put both~~ into one cluster. In fact, they were in two difference cluster. Therefore, there were actually five clusters as shown in Figure 2, i.e. Clusters I (December 2012, January 2013, March 2013) representing inundation periods, Cluster II (February 2013) representing ~~a~~the highest water level, Cluster III (April 2013) representing the beginning of low water level, Cluster IV (May 2013, June 2013, July 2013 and August 2013) representing the lowest water level or dry season, and Cluster V (September 2013, October and November 2013) representing the beginning of next flood~~ing~~ season. This grouping, then, is used to compare seasonal trophic state index in floodplain area.	Analisis cluster tidak kami gunakan lagi karena nilai yang tidak berbeda nyata antar cluster, selain itu untuk memperjelas perbedaan musim didasarkan pada perbedaan ketinggian muka air, sehingga dalam satu tahun penelitian hanya terbagi menjadi 3 musim yaitu musim banjir 1, musim surut dan musim banjir 2 (Figure 2). Alinea 1 berubah menjadi : Water level fluctuation as shown in Figure 2 grouping the 12 months of the research into 3 seasons, i.e. first flood or inundation season (FS1), low water level or dry season (DS), and second flood or nundation season (FS2). This grouping, then, is used to compare seasonal trophic state index in floodplain area.
b. Alinea 2 The ratio of TN : TP in all ~~stations~~ sampling stations for five clusters and two seasons are shown in Table 2. Tthe TN:TP values during ~~sumarized for two season shows that~~ the flood season is higher than those of during the dry season ~~unless on contrary in~~ except for the riverine system (KH and LH). Actual concentration value of both TN and TP were high (range of mean values 43.03-57.08 mg/L and 2.64-4.93 mg/L, respectively) (lihat Table 3).	b. Alinea 2 The ratio of TN : TP in all sampling stations for each seasons are shown in Table 2. The TN:TP values during the second flood season higher than first flood season and dry season. Actual concentration value of both TN and TP were high for each season and station (Table 3). Data TN dan TP sudah dibuat antar stasiun dan antar musim, namun secera keseluruhan nilai yang diperoleh tinggi pada keseluruhan musim dan stasiun.
c. Alinea 3 dan 4 The Ttrophic status of Lubuk Lampam floodplain based on Carlson's TSI and TLI values in each cluster are shown in Figure 3 and 4. The highest mean of TSI	c. Alinea 3

and TLI values ~~is~~are in dry period~~s~~ (cluster IV) (Figure 3 and 4). This pattern was also found in seasonal periods ~~Trophic status of floodplain based on Carlson's TSI and TLI value~~ (Figure 5)~~.~~;~~that~~ the mean values of TSI and TLI tend to be higher in the dry season compare to ~~than in~~ flood season.The TSI and TLI for nutrients (TP and TN) were higher than TSI and TLI of ~~both~~ secchi depth and chlorophyll-a (Figure 4-6). Based on the mean of TSI values among stations (Figure 5), the highest TSI value~~s~~ was found ~~o~~in channels of oil palm plantation (CP).	The trophic status of Lubuk Lampam floodplain based on Carlson's TSI and TLI values in each stations and seasons are shown in (Figure 3 and 4). The mean values of TSI and TLI were shown that LLF was on hyper-eutrophic status. TSI and TLI nutrients (TP and TN) were higher than TSI and TLI of Secchi depth and chlorophyll-a (Figure 3-4). The mean values of TSI and TLI tend to be higher in the dry season compare to flood season. Meanwhile based on the mean of TSI and TLI values among stations (Figure 3-4), the highest TSI and TLI values was found in channels of oil palm plantation (Sta. 5). Based on two-tailed t-test, there was no significant mean difference of TSI and TLI among stations (t-value 1.95), and among seasons (t-value 1.36).
Based on two-tailed t-test ~~results~~, there wa~~s~~ere no significant mean difference of TSI and TLI among the clusters (t-value 1.07), among the stations ~~in~~based on the cluster~~s~~ (t-value 2.16), and between the seasons (t-value 1.92), but significant mean difference was found amongthe stationsbased ~~i~~onthe season~~s~~ (t-value 2.29).	
d. Alinea 5 The results of ~~T~~this study ~~results~~ showed that the "b" value from LWR (Figure ~~8~~6) show that. The "b" values of most of the studied fish were more than 3 (Figure 6). Meanwhile the GSI of the three fish species of fishes in LubukLampam showed in Figure 7.	d. Alinea 5 This results of this study showed that the "b" value from LWR (Figure 5) show that the "b" values of most of the studied fish were more than 3. Meanwhile the GSI of the three fish species of fishes in Lubuk Lampam showed in Figure 6. GSI values of *O. vittatus* 2.53-6.81 (male) and 3.00-15.86 (female); *H. temmincki* 0.28-3.33% (male) and 1.30-10.43% (female); *C. striata* (0.33-0.59% (male) and 0.21-2.73% (female)
	Nama spesies *Osteochilus hasseltii* sudah berganti menjadi *O. vittatus*
6. Discussion	Singkatan LWR (lenght weigt relationship) sudah kami berikan kepanjangannya pada bagian materaial and methods
a. Alinea 1	

The ~~H~~high concentrations of TN and TP in LLF were due to high nutrient in this area. These results were concord with the ~~Result~~ study results ~~from~~of Venterink *et al*. [48] showings the importance of a floodplain ~~for~~ as a nutrient retention mainly for Nitrogen and Phosphorus. ~~It's caused high concentration of these two nutrients in floodplain area.~~~~Otherwise~~However, ~~ratio TN : TP~~ in some ~~of~~ stations the ratio of TN:TP were tend to be phosphorus as a limitting factor~~s~~(TN:TP > 30) and in several stations the ratio were balance (10:1≤ TN/TP ≥30:1).	Hasil GSI sudah kami lengkapi
b. Alinea 2 Based on TSI and TLI, all ~~of~~clusters had ~~are on~~ hypereutrophic status. The hypereutrophic status of Lubuk Lampam were affected by ~~both~~ natural characteristi~~c~~ and anthropogenic substances. Naturally, floodplain ~~rivers~~ is a high productivity ecosystem[49]. The establishment ~~Development~~ of oil palm plantations in recent years could be the source~~s~~ of the anthropogenic susbtances in Lubuk Lampam. According to Huibin [20], lake that has~~was~~ ~~a~~t eutrophic and hypereutrophic ~~levels~~status ~~,~~are mainly affected by natural condition and anthropogenic activities such as domestic sewage, and industrial and non-point source pollution. Organic pollutants, fertilizer-born nutrients (mainly ~~n~~Nitrogen and ~~p~~Phosphorus) and heavy metals can reach water coarses through direct discharge, leaching or with eroded soil particles [50].	6. Discussion a. Alinea 1 The high concentrations of TN and TP in LLF were due to high nutrient in this area. These results were concord with the study results of Venterink *et al*. [48] showing the importance of a floodplain as a nutrient retention mainly for Nitrogen and Phosphorus. However, in some stations the ratio of TN:TP were tend to be phosphorus as a limitting factor (TN:TP>30) and in several stations the ratio were balance (10:1≤ TN/TP ≥30:1). b. Alinea 2 Based on TSI and TLI, all stations and season had hyper-eutrophic status. The hyper-eutrophic status of Lubuk Lampam were affected by natural characteristic and anthropogenic substances. Naturally, floodplain is a high productivity ecosystem [49]. The establishment of oil palm plantations in recent years could be the source of the anthropogenic susbtances in Lubuk Lampam. According to Huibin [20], lake that has eutrophic and hypereutrophic status are mainly affected by natural condition and anthropogenic activities such as domestic sewage, and industrial and non-point source pollution. Organic pollutants, fertilizer-born nutrients (mainly Nitrogen and Phosphorus) and heavy metals can reach water course through direct discharge, leaching or with eroded soil particles [50].
c. Alinea 3 The ~~T~~trophic state of a floodplain is affected by season. According to Junk and Bayley [51], a floodplain ~~are~~is most productive during the dry season. It is possible ~~could be happen~~ because ~~in~~ during the dry seasonthe optimal primary productivity~~, trophic status which~~ is greatly influenced by the ~~optimal primary productivity that supported by~~ optimal light intensity and the avaibility of nutrient which in turn affect the trophic status. Eventhough, Junk [26] stated that ~~in many river floodplains,~~ the input of fertile sediments and dissolved nutrients ~~that be~~ carried by flood~~ing~~ was the main caused of the high productivity in many floodplains ~~rivers~~.	c. Alinea 3 The trophic state of a floodplain is affected by season showed by higher value of TSI and TLI in the dry season than flood season. According to Junk and Bayley [51], a floodplain is most productive during dry season. It is possible because during dry season, the optimal primary productivity, is greatly influenced by the optimal light intensity and the avaibility of nutrient which in turn affect the trophic
d. Alinea 4	

The ~~H~~highTSI~~nutrient~~values (TP and TN) are affected by high concentration of these two nutrients. According to Richardson [18], a large proportion of phosphorus in freshwater occurs as organic phosphates and cellular constituents in the biota or is adsorbed ~~to~~ as inorganic and dead particulate matter. High~~ly~~ concentration of TP and TN in floodplain are mainly composed by particulate form. It~~'s~~ shows from the compositon~~aring~~ values between TP and orthophosphate as dissolved form, also between TN and dissolved nitrogen form i.e. nitrate and nitrite (Table 3). Noe and Hupp [52] stated that the~~H~~high TP and TN concentration caused by the enteringconstituents~~entering to~~ the floodplain through flowpath during the flood~~ing~~. The TP concentration of a floodplain is ~~large~~ high and it~~'s~~ is caused mainly by particulate P fraction~~ation~~. Meanwhile, high TN concentration during flood~~ing~~ is caused by the decreasing 6% of dissolved organic nitrogen (DON) and increasing 5% of particulate organic nitrogen (PON).	status. Eventhough, Junk [26] stated that the input of fertile sediments and dissolved nutrients carried by flood was the main cause of the high productivity in many floodplains.
	d. Alinea 4
	The high values (TSI TP, TLI TP and TLI TN) are affected by high concentration of these two nutrients. According to Richardson [18], a large proportion of phosphorus in freshwater occurs as organic phosphates and cellular constituents in the biota or is adsorbed as inorganic and dead particulate matter. High concentration of TP and TN in floodplain are mainly composed by particulate form. It shows from the composition values between TP and orthophosphate as dissolved form, also between TN and dissolved nitrogen form i.e. nitrate and nitrite (Table 3). Noe and Hupp [52] stated that the high TP and TN concentration caused by the entering constituents to the floodplain through flowpath during the flood. The TP concentration of a floodplain is high and it is caused mainly by particulate P fraction. Meanwhile, high TN concentration during flood is caused by the decreasing 6% of dissolved organic nitrogen (DON) and increasing 5% of particulate organic nitrogen (PON).
	Indeks TSI merupakan indeks yang diperoleh dari rata-rata indeks TSI chlorophyl, secchi disk depth dan Total fosfor (TP), sedangkan indeks TLI ditambah dengan TLI dari total Nitrogen (TN). Nilai TSI TP, TLI TP dan TLI TN yang tinggi disebabkan oleh tingginya konsentrasi total fosfor dan nitrogen yang diperoleh. Nitrogen dan Fosfor merupakan nutrient yang terdapat di perairan.
e. Alinea 5	
The ~~area of~~ channel plantation (CP) ~~w~~has~~d~~ the highest TSI values and this area was alsocategorized as highly polluted [27]. According to Dembkowski [53], runoff from agricultural fields may contain high concentration of phosphorus and nitrogen-based pesticides and fertilizers, contributing to eutrophication. This station has~~d~~ high concentration of nutrients i.e. phosphorus and nitrogen (Table 3) and also tend to be contaminated by several anthropogenic substances (Table 4). ~~Even~~ Although the concentration of the contaminants were less than the results ~~studies~~ from several researchstudies ~~researchers~~ and many environmental and public health regulation~~ry authorities~~ [54-63], ~~unless~~	e. Alinea 5 The channel plantation (CP) had the highest TSI values and this area was also categorized as highly polluted [27]. According to Dembkowski [53], runoff from agricultural fields may contain high concentration of phosphorus and nitrogen-based pesticides and fertilizers, contributing to eutrophication. This station had high concentration

however, oil and ~~G~~grease consentration was above the permissible value (PV, ~~)~~i.e.~~(~~1 mg/L) from the Indonesian Government Regulation No. 82/2001 [64].

f. Alinea 6

In spite of the two-tailed t-test result showed that significant mean difference among stations in season, but considering to the clasification values criteria, all stations were in hyper-eutrophic state.Hence, we can use th~~i~~ese two formulas.~~e~~Eventhough, Wu *etal.* [65] suggested to use TLI because it is simpler, faster and more accurate. On the other hand, several otherresearchers [17-18] suggested to use TSI if TP as the limit~~t~~ing factor~~s~~, and use TLI if TN as the limit~~t~~ing factor~~s~~ or nutrient balance.

g. Alinea 7

Relationship between trophic state ~~habitat~~ and leng~~h~~th-weight relationship (LWR) was reported by Moutopoulos [66]. Th~~is~~results of this study ~~results~~ showed that the "b" value from LWR~~were~~ estimated for the three ~~3~~ studied fish species ~~of fishes~~ represent~~ingfishes~~ floodplain fishes ~~group based on~~according to Welcomme [41].It ~~and also~~ represent~~sing~~ also different food habit of the studied fishes (*O. hassseltii* and *H. temmincki* tend to be herbivore, ~~whereas the~~and*C. striata* is carnivor~~ca~~ [25,67-68]. The "b" value~~s~~ of most ~~of~~ fish~~es~~were~~is~~ more than 3 meaning~~that~~the fish~~es~~ become~~s~~ weighter as its grows and also showing the area offers good condition to these population [69-70]. The TSI value is related to the foodavailab~~i~~lity for the fish [63]. Abundant food supply and sufficient space area throughout the year were probably some of the main factors contributing to the steady increase in fish weight and leng~~h~~th[42-70].

h. Alinea 8

The GSI of fish as one of reproductive indicators also can be used to represent influence of trophic state to reproductive pattern of fish. The high tropic state on cluster IV and V cause GSI of three species of fishes also high.GSI of fish is higher in eutrophic water than oligotrophic, it's may be a result of greater nutrient of nutrients i.e. phosphorus and nitrogen (Table 3) and also tend to be contamined by several anthropogenic substances (Table 4). Although the concentration of the contaminants were less than the results from several research studies and many environmental and public health regulation [54-63]. However, oil and grease concentration was above the permissible value (PV), i.e. 1 mg/L from the Indonesian Goverment Regulation No, 82/2001 [64].

f. Alinea 6

In spite of the two-tailed t-test of TSI and TLI values showed that significant mean difference among stations in season, but considering to the clasification values criteria, all stations were in hyper-eutrophic state. Hence, we can use these two formulas. Eventhough Wu *et al.* [65] suggested to use TLI because it is simpler, faster and more accurate. On the other hand, several other researchers [17-18] suggested to use TSI if TP as the limiting factor, and use TLI if TN as the limiting factor or nutrient balance.

g. Alinea 7

Relationship between trophic state and length-weight relationship (LWR) was reported by Moutopoulos [66]. The results of this study showed that the "b" value from LWR estimated for the three studied fish species represent floodplain fishes according to Welcomme [41]. It represent also different food habit of the studied fishes (*O. vittatus* and *H. temmincki* tend to be herbivore, and *C. striata* is carnivore [25,67-68]. The "b" value of most fishes is more than 3 meaning the fishes become weighter and also showing the area offers good condition to these population [69-70]. The TSI values is related to the food availability for the fish [63]. Food supply and sufficient space area throughout the year were probably contributing to the steady increase in fish weight and length [42-70].

availability[71].

7. Conclusions

Based on Carlson's TSI and TLI formulaindicated that LubukLampam is on the hypertrophic state. In the case of floodplain~~rivers~~, these two methods can be usedfor estimating the trophic status. The high trophic status of the aquatic system gave positive effect to the increase ~~addition~~ of the body weight and the GSI of the studied fish~~es~~.

8. Acknowledgement

Financial support was received from ~~scholarship of~~the Directorate General of Higher Education, Ministry of Education and Culture, Indonesia. We are grateful to Laboratory of Fisheries, and also Laboratory of ~~c~~Chemical, ~~b~~Biological and ~~p~~Productivity of ~~s~~Soil, Faculty of Agriculture, Sriwijaya University; Laboratory of Productivity and Environment~~al, and also~~ Laboratory of Biology, Departement of Fisheries Resources Management, Bogor Agricultural University; Research Institute for Inland Water Fisheries; and Laboratory of Agrochemicals Residues, Environmental Research Institute, Ministry of Agriculture, Indonesia.

9. References

[26] Junk, W.J. 1996. Perspectives in Tropical Limnology. In: Schiemer,F., Boland, K.T. (eds.), xxx. SPB Academic Publishing by

h. Alinea 8

The GSI of fish as one of reproductive indicators also can be used to represent influence of trophic state to gonadic growth of fish. GSI of fish is higher in eutrophic water than oligotrophic, it's may be a result of greater nutrient availability [71]. GSI values for *O. vittatus* each stations and seasons were high (2.53-6.81 % for male and 3.00-15.86% for female) eventhough still under GSI values for cultured *O. vittatus* (21.25±4.41%) [72]. GSI values for H. temmincki (0.28-3.33% for male and 1.30-10.43% for female), meanwhile other studies showed the GSI values 4.48% [73]. GSI values for C. striata for male (0.33-0.59%) higher than the GSI values from other studies (0.05-0.37%), meanwhile for female (0.21-2.73%) lower than GSI values from other studies (1.08-4.8%) [74].

7. Conclusions

Based on Carlson's TSI and TLI formula it was indicated that Lubuk Lampam in the hyper-eutrophic state. In this research, those two methods can be used for estimating the trophic status. The high trophic status of the aquatic system gave positive effect to the increase of the body weight and the GSI of the studied fishes.

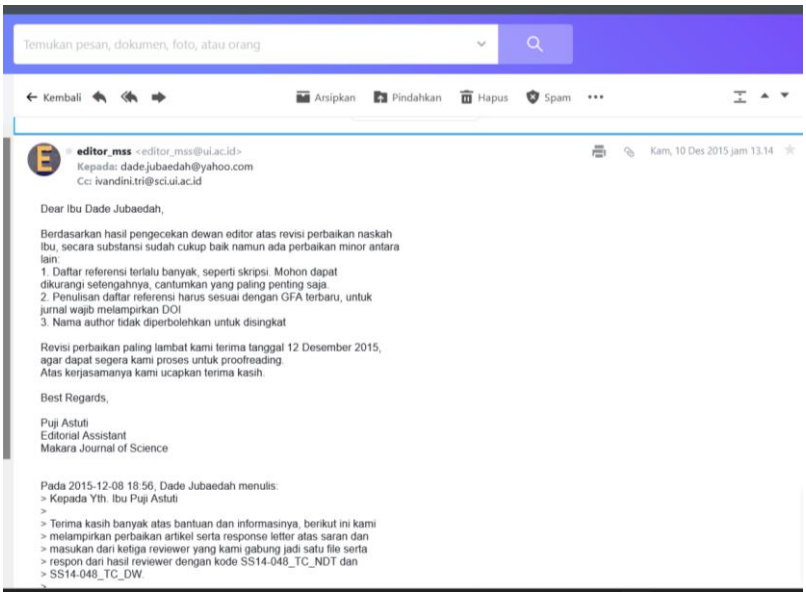
8. Acknowledgement

Financial support was received from the Directorate General of Higher Education, Ministry of Education and Culture, Indonesia. We are grateful to Laboratory of Fisheries, and also Laboratory of Chemical, Biological and Productivity of Soil, Faculty of Agriculture, Sriwijaya University; Laboratory of Productivity and Environment and Laboratory of Biology, Departement of Fisheries Resources Management, Bogor Agricultural University; Research Institute for Inland Water Fisheries; and Laboratory of Agrochemicals Residues, Environmental Research Institute, Ministry of Agriculture, Indonesia.

9. References

Amsterdam, The Netherlands, 1996, p. 255. [33]Otago Regional Council. 2005. Lake Waipori and LakeWaihola : Trophic Level Status. Lake Waipori & Lake Waihola Trophic Level Status Report. p.53. [53]Dembkowski, D.J. 2011. Fish biodiversity in floodplain lakes of the Mississipi aluvial valey. Master of Science Thesis, Faculty of, Mississippi State University, United States. p.82 [60]Coupe,R.H., Kalkhoff,S.J., Capel,P.D.,Gregorie, C. 2011. Fate and transport of glyphosate and aminomethylphosphonic acid in surface waters of agricultural basins. Pest Management Sciences .wileyonlinelibrary.com) DOI 10.1002/ps.2212. Figure 3-6	[26] Junk, W.J. 1996. Ecology of floodplains – a challenge for tropical limnology. In: Schiemer, F., Boland, K.T. (eds.), Perspectives in Tropical Limnology. SPB Academic Publishing by Amsterdam, The Netherlands, 1996, p. 255. [33] Otago Regional Council. 2005. Lake Waipori & Lake Waihola Trophic Level Status Report p.53. [53] Dembkowski, D.J. 2011. Fish biodiversity in floodplain lakes of the Mississipi aluvial valey. Master Sciences Thesis, Departement of Wildlife, Fisheries and Aquaculture, Mississippi State University, United States. p.82 [60] Coupe, R.H., Kalkhoff, S.J., Capel, P.D., Gregorie, C. 2011. Fate and transport of glyphosate and aminomethylphosphonic acid in surface waters of agricultural basins. Pest Management Sciences wileyonlinelibrary.com) DOI 10.1002/ps.2212. Figre 3-6 : berwarna

6.Bukti perbaikan dari dari editor dan perbaikannya (10 dan 12 Desember 2015)



Temukan pesan, dokumen, foto, atau orang

Kembali | Arsipkan | Pindahkan | Hapus | Spam | ...

editor_mss <editor_mss@ui.ac.id>
Kepada: dade.jubaedah@yahoo.com
Cc: ivandini.tri@sci.ui.ac.id
Kam, 10 Des 2015 jam 13.14

Dear Ibu Dade Jubaedah,

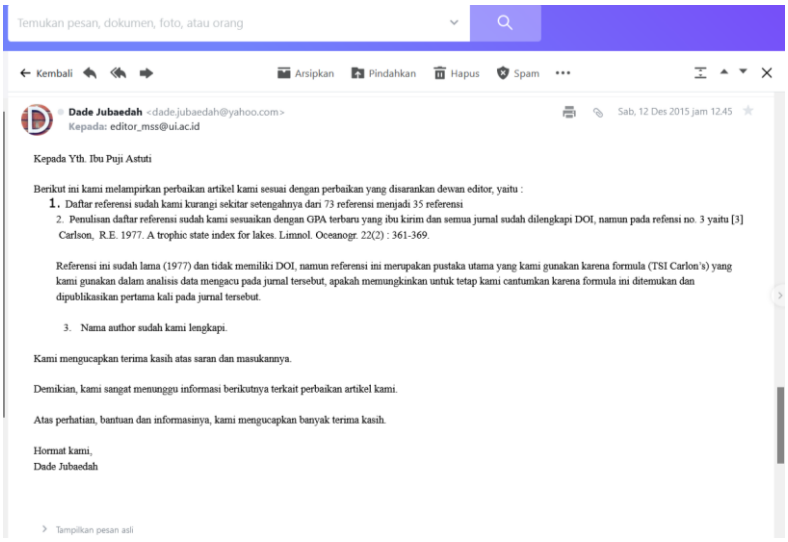
Berdasarkan hasil pengecekan dewan editor atas revisi perbaikan naskah Ibu, secara substansi sudah cukup baik namun ada perbaikan minor antara lain:
1. Daftar referensi terlalu banyak, seperti skripsi. Mohon dapat dikurangi setengahnya, cantumkan yang paling penting saja.
2. Penulisan daftar referensi harus sesuai dengan GFA terbaru, untuk jurnal wajib melampirkan DOI
3. Nama author tidak diperbolehkan untuk disingkat

Revisi perbaikan paling lambat kami terima tanggal 12 Desember 2015, agar dapat segera kami proses untuk proofreading.
Atas kerjasamanya kami ucapkan terima kasih.

Best Regards,

Puji Astuti
Editorial Assistant
Makara Journal of Science

Pada 2015-12-08 18:56, Dade Jubaedah menulis:
> Kepada Yth. Ibu Puji Astuti
>
> Terima kasih banyak atas bantuan dan informasinya, berikut ini kami
> melampirkan perbaikan artikel serta response letter atas saran dan
> masukan dari ketiga reviewer yang kami gabung jadi satu file serta
> respon dari hasil reviewer dengan kode SS14-048_TC_NDT dan
> SS14-048_TC_DW.



Temukan pesan, dokumen, foto, atau orang

Kembali | Arsipkan | Pindahkan | Hapus | Spam | ...

Dade Jubaedah <dade.jubaedah@yahoo.com>
Kepada: editor_mss@ui.ac.id
Sab, 12 Des 2015 jam 12.45

Kepada Yth. Ibu Puji Astuti

Berikut ini kami melampirkan perbaikan artikel kami sesuai dengan perbaikan yang disarankan dewan editor, yaitu :

1. Daftar referensi sudah kami kurangi sekitar setengahnya dari 73 referensi menjadi 35 referensi
2. Penulisan daftar referensi sudah kami sesuaikan dengan GPA terbaru yang ibu kirim dan semua jurnal sudah dilengkapi DOI, namun pada refensi no. 3 yaitu [3] Carlson, R.E. 1977. A trophic state index for lakes. Limnol. Oceanogr. 22(2) : 361-369.

   Referensi ini sudah lama (1977) dan tidak memiliki DOI, namun referensi ini merupakan pustaka utama yang kami gunakan karena formula (TSI Carlon's) yang kami gunakan dalam analisis data mengacu pada jurnal tersebut, apakah memungkinkan untuk tetap kami cantumkan karena formula ini ditemukan dan dipublikasikan pertama kali pada jurnal tersebut.

3. Nama author sudah kami lengkapi.

Kami mengucapkan terima kasih atas saran dan masukannya.

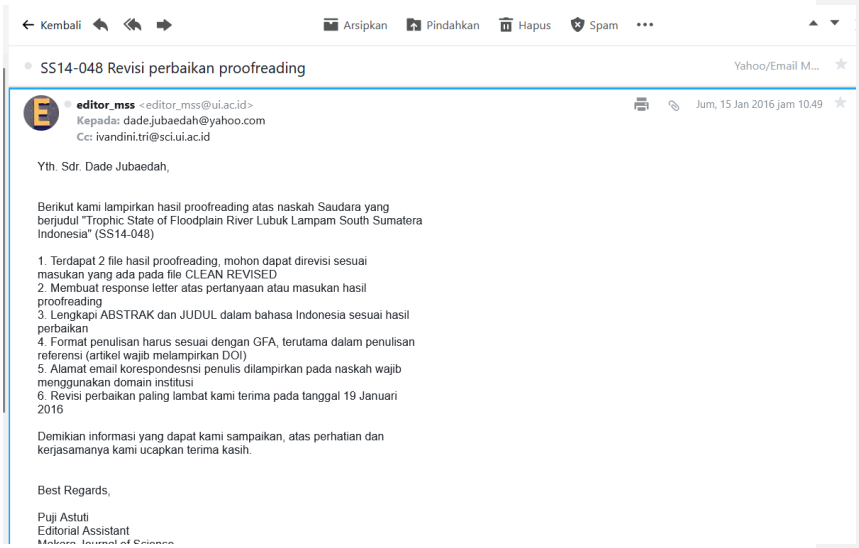
Demikian, kami sangat menunggu informasi berikutnya terkait perbaikan artikel kami.

Atas perhatian, bantuan dan informasinya, kami mengucapkan banyak terima kasih.

Hormat kami,
Dade Jubaedah

Tampilkan pesan asli

7. Bukti Proofreading (15 Januari 2016)



← Kembali Arsipkan Pindahkan Hapus Spam •••

SS14-048 Revisi perbaikan proofreading Yahoo/Email M...

editor_mss <editor_mss@ui.ac.id>
Kepada: dade.jubaedah@yahoo.com
Cc: ivandini.tri@sci.ui.ac.id

Jum, 15 Jan 2016 jam 10.49

Yth. Sdr. Dade Jubaedah,

Berikut kami lampirkan hasil proofreading atas naskah Saudara yang berjudul "Trophic State of Floodplain River Lubuk Lampam South Sumatera Indonesia" (SS14-048)

1. Terdapat 2 file hasil proofreading, mohon dapat direvisi sesuai masukan yang ada pada file CLEAN REVISED
2. Membuat response letter atas pertanyaan atau masukan hasil proofreading
3. Lengkapi ABSTRAK dan JUDUL dalam bahasa Indonesia sesuai hasil perbaikan
4. Format penulisan harus sesuai dengan GFA, terutama dalam penulisan referensi (artikel wajib melampirkan DOI)
5. Alamat email korespondesnsi penulis dilampirkan pada naskah wajib menggunakan domain institusi
6. Revisi perbaikan paling lambat kami terima pada tanggal 19 Januari 2016

Demikian informasi yang dapat kami sampaikan, atas perhatian dan kerjasamanya kami ucapkan terima kasih.

Best Regards,

Puji Astuti
Editorial Assistant

The Trophic Status of the Lubuk Lampam Floodplain in South Sumatera, Indonesia

Abstract

The Lubuk Lampam floodplain's ecosystem is naturally affected by the fluctuation of the water surface. This ecosystem also receives anthropogenic substances such as nutrients and other chemicals, especially from the oil palm plantation and its industrial processing activities. The main objective of this research was to determine the trophic status of the floodplain using the Trophic Level Index (TLI) and Carlson's Trophic State Index (TSI). The water quality and the fish samples were collected and analyzed from 7 stations representing various types of floodplain habitat. The results showed that the trophic status of Lubuk Lampam was hypereutrophic (very nutrient-rich). This was also supported by the high increase of the body weight ("b" value more than 3) and the high gonadosomatic index (GSI) of the studied fishes, i.e. *Osteochilus vittatus* 2.53-6.81% % (male) and 3.00-15.86% (female); *Helostoma temminckii* 0.28-3.33% (male) and 1.30-10.43% (female); and *Channa striata* 0.33-0.59% (male) and 0.21-2.73% (female).

Key words : floodplain, trophic status, Lubuk Lampam

21. Introduction

There are many methods used to assess the trophic state of water bodies, from single- to multiple-parameter models [1-3]. The most commonly used method was introduced by Carlson [3], i.e. the trophic state index (TSI), in which the calculation is determined by the quantities of total phosphorus, chlorophyll-a, and water transparency. Later, the TSI index was modified by adding total nitrogen to the equation to create the trophic level index (TLI) [4-6].

Both Carlson's TSI and TLI are applicable in determining the trophic status of stagnant waters, including lakes and reservoirs. However, Carlson [3] stated that TSI was also appropriate to be used for flowing bodies of water such as rivers. In comparison with lakes and rivers, water bodies in floodplains are characterized by both lotic and

lentic components [7]. The oscillation between the terrestrial and aquatic phases resulted from the fluctuation of the water level. Therefore, these areas are periodically inundated by the lateral overflow of rivers [8].

Since floods originate from three sources, i.e. overspill from the river channels, local rainfall, and tides, the fluctuation of these sources will cause changes in floodplain water quality, which in turn will affect the trophic status of the floodplain. According to Welcomme [7], the great fluctuation in water levels causes a seasonal cycle of flood and drought over much of the area. Extreme changes in water chemistry and primary production also occur throughout the cycle. Determining the trophic status of floodplains is important because the indexes can be used as a predictive tool for effective water management programs [3, 6].

Lubuk Lampam is one of the important floodplains situated in the Ogan Komering Ilir district. The main river in this area is Lempuing River, a tributary of the Komering River. This area is a natural floodplain that is important for ecological balance. Meanwhile, this area is also important for local economic growth, especially from fisheries and agricultural activities [9]. The government has designated several sites within the area as fishery reserves, such as Lebung Proyek, Suak Buayo and Kapak Hulu, as shown in Figure 1. The greatest potential threat to this floodplain is land conversion for agriculture, i.e. deforestation and land clearance for the oil palm plantation and its industrial processing activities. Those activities affect the water quality due to the leaching of pesticides, fertilizers and other agrochemicals [10].

There is limited information about the trophic state of the Lubuk Lampam floodplain (LLF). This study, therefore, aims to reveal the trophic status of this floodplain in relation to water level fluctuation and anthropogenic substances, mainly from the oil palm plantation.

22. Material and Methods

Seven sampling sites were established upstream, inside and downstream of LLF (Figure 1), i.e. 1) Kapak Hulu, at the upper course of the main river (station 1); 2) flooded grassland 1 (station 2); 3) Suak Buayo, a natural floodplain pool (station 3); 4) Lebung Proyek, a man-made floodplain pool (station 4); 5) drainage channels from the oil palm plantation (station 5); 6) flooded grassland 2 (station 6); and 7) Lempuing Hilir, downstream of LLF (station 7). Sampling was done monthly at all sites except for the flooded grasslands (station 1 and station 6), at which samples were collected only during flood season.

Fish sampling and water quality data were collected from December 2012 to November 2013, while the anthropogenic substances (detergent, herbicide, and oil and grease) were sampled only during the flooding, highest water level, and dry seasons. The water samples were collected, preserved, kept cooled at 4^{o}C, and analyzed based on standard methods [11]. Measurements on total nitrogen (TN) and total phosphorus (TP) were performed by using a spectrophotometric analyzer. Chlorophyll-a (Chl a) was collected, preserved with $MgCO_3$ and determined using the spectrophotometric method. Oil and grease levels were analyzed using the gravimetric method, detergent was analyzed using a spectrophotometric analyzer, and herbicide was measured using gas chromatography.

TN:TP criteria are classified into three categories : nitrogen limited (TN/TP < 10:1), phosphorus limited (TN/TP > 30:1), and balanced (10:1≤ TN/TP ≥30:1) [4-5]. Trophic state of Lubuk Lampam was calculated by using the Carlson's TSI value [3, 12]. The TSI formulas were:

$$TSI_{SD} = 10x[6-(\ln SD/\ln 2)] \quad (1)$$

$$TSI_{Chl\ a} = 10x[6-((2.04-0.68 \ln Chl\ a)/\ln 2)] \quad (2)$$

$$TSI_{TP} = 10x[6-\ln(48/TP)/\ln 2] \quad (3)$$

$$TSI = [TSI(P)+TSI(chl\ a)+TSI(SD)]/3 \quad (4)$$

Where SD = Secchi depth (m); Chl a = chlorophyll-a (µg/L); P = total phosphorus (µg/L)

The modified TSI formula, namely the Trophic Level Index (TLI) [13], was calculated by:

$TLI_{Chl\text{-}a} = 2.22+2.54log_{10}(Chl\ a)$ (5)

$TLI_{SD}=5.10+2.60log_{10}(1/S\text{-}1/40)$ (6)

$TLI_{TP}=0.218+2.92log_{10}(TP)$ (7)

$TLI_{TN}=\text{-}3.61+3.10log_{10}(TN)$ (8)

$TLI = \Sigma(TLI_{Chl\ a} + TLI_{SD} + TLI_{TP} + TLI_{TN})/4$ (9)

Where TN = total nitrogen (µg/L).

The classification values based on TSI and TLI are shown in Table 1. Both TSI and TLI were analyzed based on stations and season. The mean of TSI and TLI was tested by t-test at the 0.05 significance level.

In this study, 3 species of fishes i.e. *Osteochilus vittatus* (n=805), *Helostoma temminckii* (n=793) and *Channa striata* (n=397) were caught in Lubuk Lampam. The samples were collected by using gillnet (0.5. 0.75, 1.0, 1.5, 2.0, 2.5, 3.0- mm mesh size) and portable traps. Then the samples were measured for their total length (TL) and total wet weight.

The length of the fish was measured to the nearest 0.5 mm, and the weight to the nearest 0.01 mg. The length-weight relationship (LWR), $W=aL^b$,was converted to a logarithmic expression: log W = log a + b log L. In this formula, W is weight in gram, and L is total length in mm. The "a" and "b" parameters were determined according to the power regression model. The "b" value for each species was tested by t-test at the 0.05 significance level to verify if it was significantly different from 3 [16-17].

The sex of the fish samples was determined through macroscopic gonad morphology examination (45). Later, the gonads were weighed and subsequently preserved in Gilson's solution. Seasonal changes in gonad mass for both sexes were determined by using the gonadosomatic index (GSI). The GSI is calculated as GSI (%) = 100 x (weight of gonad / weight of fish) [16-17].

23. Results

As shown in figure 2, the study's measurement of water level fluctuation divides the 12 months of the research into 3 seasons, i.e. first flood or inundation season (FS1), low water level or dry season (DS), and second flood or nundation season (FS2). This grouping, then, is used to compare seasonal trophic state index values in the floodplain area.

The ratios of TN:TP for all sampling stations and seasons are shown in Table 2. The TN:TP values during the second flood season (FS2) are higher than those for the first flood season and dry season. The actual concentration values of both TN and TP were high for each season and station (Table 3).

The trophic status of the Lubuk Lampam floodplain based on Carlson's TSI and TLI values for each station and season are shown in (Figure 3 and 4). The mean values of TSI and TLI both showed that LLF was hypereutrophic. The TSI and TLI levels for nutrients (TP and TN) were higher than the TSI and TLI for Secchi depth and chlorophyll-a (Figure 3-4). The mean values of TSI and TLI tend to be higher in the dry season compared to the flood season. Meanwhile, based on the mean of TSI and TLI values among stations (Figure 3-4), the highest TSI and TLI values were found in the drainage channels of the oil palm plantation (Station 5). Based on a two-tailed t-test, there was no significant mean difference in TSI and TLI among stations (t-value 1.95) or among seasons (t-value 1.36).

This results of this study showed that the "b" value from LWR (Figure 5) for most of the studied fish were more than 3. Meanwhile, the GSI values of the three species of fishes in Lubuk Lampam, as shown in Figure 6, were as follows: *O. vittatus* 2.53-6.81 (male) and 3.00-15.86 (female); *H. temminckii* 0.28-3.33% (male) and 1.30-10.43% (female); and *C. striata* (0.33-0.59% (male) and 0.21-2.73% (female).

24. Discussion

The high concentrations of TN and TP in LLF were due to a high number of nutrients in this area. These results concurred with the study results of Yarbro *et al.* [18], who showed the importance of a floodplain as a nutrient retainer, mainly for nitrogen and phosphorus. However, in some stations the ratio of TN:TP suggests that phosphorus is functioning as a limiting factor (TN:TP>30), whereas at other stations the ratio was balanced (10:1≤ TN/TP ≥30:1).

Based on TSI and TLI, all stations and seasons had hyper-eutrophic status. The hypereutrophic status of the Lubuk Lampam floodplain was affected by natural characteristics and anthropogenic substances. Naturally, a floodplain is a high productivity ecosystem [19]. The establishment of oil palm plantations in recent years could be the source of the anthropogenic substances found in Lubuk Lampam. According to Huibin [6], lakes that are categorized as eutrophic and hypereutrophic are mainly affected by natural conditions and anthropogenic activities such as domestic sewage, as well as industrial and non-point source pollution. Organic pollutants, fertilizer-born nutrients (mainly nitrogen and phosphorus) and heavy metals can reach the watercourse through direct discharge, leaching or eroded soil particles [20].

The trophic state of a floodplain is affected by season. This study showed higher values of TSI and TLI in the dry season than during the flood season. According to Junk and Bayley [21], a floodplain is most productive during dry season. It is possible that this is because during the dry season, the optimal primary productivity is greatly influenced by the optimal light intensity and the availability of nutrients, which in turn affects the trophic status. However, Junk [8] stated that fertile sediments and dissolved nutrients carried by flood waters were the main cause of the high productivity in many floodplains.

The high values (TSI TP, TLI TP and TLI TN) are affected by the high concentration of nitrogen and phosphorus. According to Richardson [5], a large proportion of phosphorus in freshwater occurs as organic phosphates and cellular constituents in the biota or is absorbed as inorganic and dead particulate matter. The concentration of TP and TN in floodplains mainly occurs in particulate form. It shows from the composition values between TP and orthophosphate as dissolved form, and also between TN and dissolved nitrogen form, i.e. nitrate and nitrite (Table 3). Noe and Hupp [22] stated that the high TP and TN concentration is caused by the entering constituents to the floodplain through flowpath during the flood. The TP concentration of a floodplain is high and it is caused mainly by particulate P fraction. Meanwhile, high TN concentration during floods is caused by the decreasing 6% of dissolved organic nitrogen (DON) and increasing 5% of particulate organic nitrogen (PON).

The channel plantation (CP) had the highest TSI values, and this area was also categorized as highly polluted [27]. According to Dembkowski [23], runoff from agricultural fields may contain high concentrations of phosphorus and nitrogen-based pesticides and fertilizers, contributing to eutrophication. This station had a high concentration of nutrients, i.e. phosphorus and nitrogen (Table 3), and also tend to be contaminated by several anthropogenic substances (Table 4). Interestingly, the concentration level of the contaminants was lower than that measured in several research studies and also lower than the limits required by many environmental and public health regulators [24-27]. However, oil and grease concentration was above the permissible value (PV) allowed by Indonesian Government Regulation No. 82/2001, i.e. 1 mg/L [28].

In spite of the two-tailed t-test of TSI and TLI values showed that significant mean difference among stations in season, but considering to the classification values criteria, all stations were in hyper-eutrophic state. Hence, we can use these two formulas. Wu *et al.* [29] suggested to use TLI because it is simpler, faster and more accurate. On the other hand, several other researchers [4-5] suggested to use TSI if TP is the limiting factor, and use TLI if TN is the limiting factor or if the nutrients are balanced.

The relationship between trophic state and length-weight relationship (LWR) was reported by Treer *et al.* [30]. The results of this study showed that the "b" value from LWR estimated for the three studied fish species represent floodplain fishes according to Welcomme [16]. It represent also different food habit of the studied fishes (*O. vittatus* and *H. temminckii* tend to be herbivore, and *C. striata* is carnivore [7]). The "b" value of most fishes is more than 3, meaning the fishes become weightier and also showing the area offers favorable conditions to these populations. The TSI values is related to food availability for the fish [27]. Food supply and sufficient space area throughout the year were probably the main contributing factors to the steady increase in fish weight and length.

The GSI of fish, normally used as a reproductive indicator, can also be used to measure the influence of trophic state on the gonad growth of fish. The GSI of fish is higher in eutrophic water than in oligotrophic water, which

may be a result of greater nutrient availability [31]. The GSI values for *O. vittatus* for each station and season were high (2.53-6.81 % for male and 3.00-15.86% for female), though not nearly as high as the GSI values for cultured *O. vittatus* (21.25±4.41%) [32]. The GSI values for *H. temminckii* (0.28-3.33% for male and 1.30-10.43% for female), tend to be higher than those for *Anabas testudineus* as another Anabantidae showed the GSI values for female 0.13-9.84 % [33]. The GSI values for *C. striata* for male (0.33-0.59%) and female (0.21-2.73%) were lower than the GSI values of matured *C. striata* from other studies (0.6-2,10% for male and 1.4-8.0% for female) [34], though still higher than the GSI values from *Channa marulius* (0.018-0.056 for male and 0.018-0.42% for female) [35].

25. Conclusions

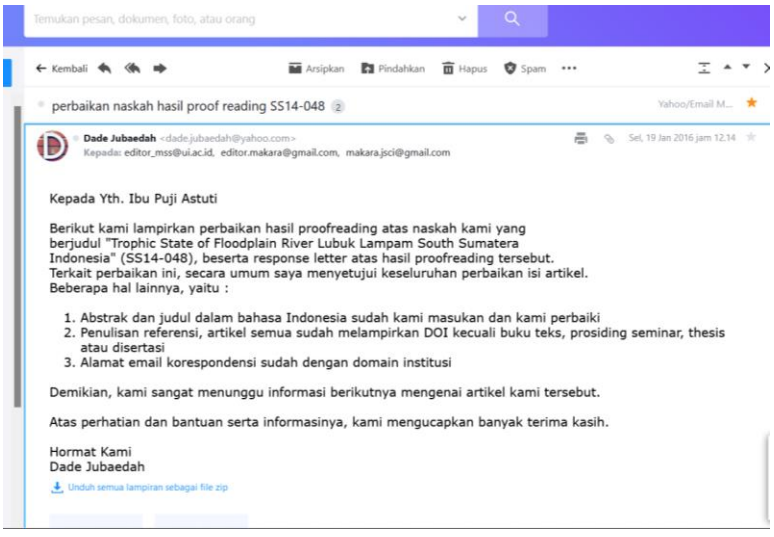
Based on the Carlson's TSI and TLI formulas, two methods that can be used to estimate the trophic status, it was indicated that the Lubuk Lampam floodplain is in a hyper-eutrophic state. The high trophic status of this aquatic ecosystem gave positive effect to the increase in body weight and GSI of the studied fishes.

Acknowledgements

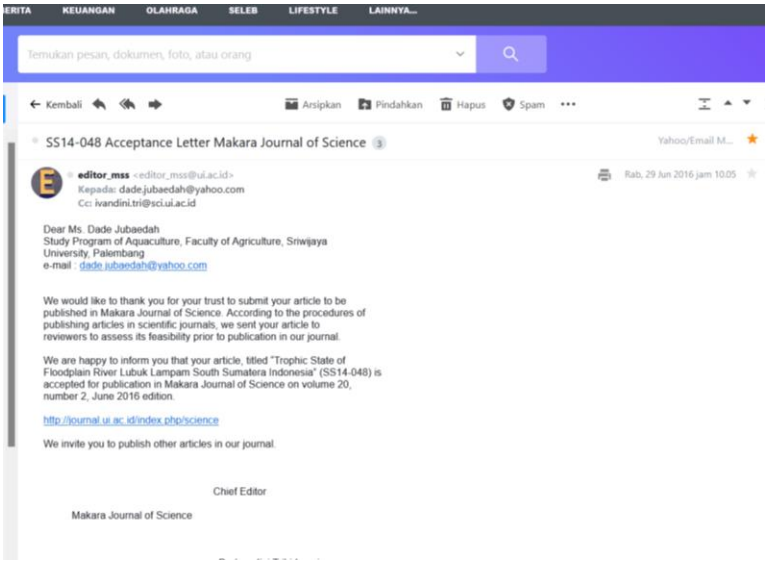
Financial support was received from the Directorate General of Higher Education, Ministry of Education and Culture, Indonesia. We are also grateful to the Laboratory of Fisheries and the Laboratory of Chemical, Biological and Productivity of Soil, Faculty of Agriculture, Sriwijaya University; the Laboratory of Productivity and Environment and the Laboratory of Biology, Department of Fisheries Resources Management, Bogor Agricultural University; the Research Institute for Freshwater Fisheries; and the Laboratory of Agrochemicals Residues, Environmental Research Institute, Ministry of Agriculture, Indonesia.

Commented [.79]: Please double-check the Laboratory names from this section, as I wasn't able to find any of them during a Google search. The first sentence is fine. In the second, "Faculty of Agriculture, Sriwijaya University" is correct, but I could not confirm the Laboratory names (Fisheries, etc.). Next, "Department of Fisheries Resources Management, Bogor Agricultural University" is correct, but I could not confirm the Laboratory names (Productivity and Environment, etc.). For "the Research Institute of Inland Water Fisheries," several sources suggest the name has changed to "Research Institute for Freshwater Fisheries." Finally, perhaps the final acknowledgement references "the Indonesian Environmental Research Institute" or the "Indonesian Agricultural Environmental Research Institute"? Also, I could not confirm the Laboratory name (Agrochemicals Residues); it could instead be Laboratory of Agrochemical Residues.

8. Bukti perbaikan proofreading (19 Januari 2016)



9. Bukti Acceptance Letter (26 juni 2016)



ERITA KEUANGAN OLAHRAGA SELEB LIFESTYLE LAINNYA...

Temukan pesan, dokumen, foto, atau orang

← Kembali Arsipkan Pindahkan Hapus Spam ...

SS14-048 Acceptance Letter Makara Journal of Science 3

Yahoo/Email M...

editor_mss <editor_mss@ui.ac.id>
Kepada: dade.jubaedah@yahoo.com
Cc: ivandini.tri@sci.ui.ac.id

Rab, 29 Jun 2016 jam 10.05

Dear Ms. Dade Jubaedah
Study Program of Aquaculture, Faculty of Agriculture, Sriwijaya University, Palembang
e-mail : dade.jubaedah@yahoo.com

We would like to thank you for your trust to submit your article to be published in Makara Journal of Science. According to the procedures of publishing articles in scientific journals, we sent your article to reviewers to assess its feasibility prior to publication in our journal.

We are happy to inform you that your article, titled "Trophic State of Floodplain River Lubuk Lampam South Sumatera Indonesia" (SS14-048) is accepted for publication in Makara Journal of Science on volume 20, number 2, June 2016 edition.

http://journal.ui.ac.id/index.php/science

We invite you to publish other articles in our journal.

Chief Editor

Makara Journal of Science