Metode Sampling
Penelitian
MAKROBENTHOS
dan Aplikasinya
Penentuan Tingkat Gangguan
Lingkungan Akuakultur

Buku ini terdiri dari 9 Bab, membahas secara mendalam tentang peranan penting makrobenthos sebagai hewan invertabrata yang hidup di habitat dasar perairan. Pada tiga bab pertama membahas definisi, identifikasi serta interaksi antara makrobenthos dengan struktur sedimen, responsnya terhadap gangguan lingkungan, sehingga sesuai sebagai bioindikator perubahan lingkungan perairan, khususnya pengkayaan organik akibat aktivitas budidaya perikanan (aquakultur). Selain itu juga dibahas peranan ekologisnya dalam pembentukan habitat sedimen, antara lain menstimulasi dan meningkatkan proses mineralisasi materi organik, dan meningkatkan pertukaran partikel dalam lapisan batas antara air dan sedimen, sehingga berperan penting dalam rantai makanan melalui transfer karbon organik kembali ke ekosistem pelagis.

Bab IV khusus membahas teknik pengambilan sampel makrobenthos dengan beberapa alternatif alat yang umum digunakan (core sampler maupun grabs), desain eksperimen , dan untuk selanjunya dilakukan fiksasi, preservasi, sortasi, dan identifikasi serta enumerasi. Bab-bab berikutnya khusus membahas aplikasi pemanfaatan struktur makrobenthos dalam menentukan tingkat gangguan lingkungan, khususnya pada area budidaya, melalui analisis struktur dengan pendekatan univariat, multivariat, dan metode grafis serta indeks multimetrik. Pendekatan ini telah banyak diterapkan sebagai salah satu kriteria utama dalam menentukan kualitas lingkungan untuk manajemen akuakultur di berbagai negara. Sebagai sebuah buku ilmiah, ulasan dalam buku ini dapat menjadi salah satu referensi berharga bagi pemangku kepentingan mulai dari para aktivis do bidang perikanan, kelautan, teknik lingkungan, ilmu biologi terapan, sains terapan, pemerhati lingkungan, penentu kebijakan, pemda, para praktisi pembudidaya perikanan, serta masyarakat pada umumnya.

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Kata Pengantar

Dengan mengucap puji syukur kehadirat Tuhan Yang Maha Esa yang telah memberikan waktu dan kesempatan serta ilmu sehingga akhirnya buku ini dapat diselesaikan sesuai dengan yang telah direncanakan. Buku ini ditulis guna ikut memberikan sumbangan pemikiran bagi bidang keilmuan yang terkait dengan biologi terapan, ekologi perairan, akuakultur, dan biomonitoring.

Buku ini mengulas berbagai hal tentang makrobenthos sebagai hewan invertabrata yang hidup di habitat dasar perairan. Keberadaan makrobenthos mempunyai peranan penting dalam pembentukan habitat sedimen, antara lain menstimulasi dan meningkatkan proses mineralisasi materi organik, dan meningkatkan pertukaran partikel dalam lapisan batas antara air dan sedimen, sehingga berperan penting dalam rantai makanan melalui transfer karbon organik kembali ke ekosistem pelagis. Definisi, identifikasi sesuai ciri-ciri marfologis maupun anatomis pada beberapa golongan makrobenthos, peranannya di habitat sedimen, teknik pengambilan sampel, serta pemanfaatannya dalam menentukan tingkat gangguan lingkungan dibahas dalam buku ini. Buku ini juga membahas analisis struktur makrobenthos

dengan pendekatan univariat, multivariat, dan metode grafis serta indeks multimetrik yang telah banyak diterapkan sebagai salah satu kriteria utama dalam menentukan kualitas lingkungan untuk manajemen akuakultur di berbagai negara.

Penulis menyadari bahwa buku ini masih memerlukan penyempurnaan baik dalam konten maupun kedalaman ulasan yang tertuang dalam masing-masing Bab. Oleh karena itu dengan kerendahan hati, penukis sangat mengharapkan masukan yang konstruktif guna menyempurnakan buku ini untuk edisi selanjutnya. Akhir kata, besar harapan penulis kiranya buku ini dapat dijadikan salah satu referensi atau acuan yang berguna dalam menelaah berbagai permasalahan lingkungan perairan, khususnya berkaitan dengan aktivitas budidaya.

Semarang, 7 Januari 2014

Penulis

Sapto P. Putro

Daftar Isi

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1 Pendahuluan

1.1 DEFINISI

Makrobenthos adalah organisme dasar perairan, baik berupa hewan maupun tumbuhan, baik yang hidup di permukaan dasar ataupun di dasar perairan. Semula hewan makrobenthos hanya digolongkan sebagai fitobenthos dan zoobenthos, tetapi Hutchinson (1976) menggolongkan benthos berdasarkan ukurannya, yaitu benthos mikroskopis atau dikenal dengan sebutan mikrobenthos dan makrobenthos. Selanjutnya Lind (1979) memberikan definisi makrobenthos sebagai organisme yang hidup pada lumpur, pasir, batu, kerikil, maupun sampah organik baik di dasar perairan laut, danau, kolam, ataupun sungai, merupakan hewan melata, menetap, menempel, memendam, dan meliang di dasar perairan tersebut. Menurut Venberg dalam Fachrul (2007), berdasarkan ukurannya benthos dibedakan menjadi tiga jenis, yaitu makrobenthos, mesobenthos dan mikrobenthos. Makrobenthos adalah organisme yang hidup di dasar perairan dan tersaring oleh saringan yang berukuran mata saring 1,0x1,0 milimeter yang pada pertumbuhan dewasanya berukuran 3-5 milimeter. Berdasarkan letaknya hewan ini dibedakan menjadi dua macam, yaitu makrobenthik infauna

2

Peranan Organisme Makrobenthos di Habitat Sedimen Perairan

Hewan makrobenthos mempunyai peranan penting dalam pembentukan habitat sedimen. Distribusi vertikal dari proses-proses yang dilakukan mikroba dalam sedimen dipengaruhi oleh hewan infauna melalui aktifitas, antara lain makan, menggali lubang, dan pembentukan rumah tabung (Gerino *et al.,* 1995). Analisis hewan makrobenthos telah diterapkan sebagai salah satu kriteria utama dalam menentukan kualitas lingkungan untuk manajemen akuakultur di berbagai negara, misalnya Jepang (Yokoyama, 2002), Tasmania-Australia (Crawford, 2003), Australia Selatan (Cheshire *et al.,* 2006; Putro *et al.,* 2006), Norway (Carroll *et al.,* 2003), Inggris (Brooks *et al.,* 2004) dan beberapa negara Eropa (Read & Fernandes, 2003), Indonesia (Putro & Suhartana, 2008; Putro, 2013; Putro *et al.,* 2012; Putro *et al.,* 2014) dan Brazil (Zalmon *et al.,* 2014).

Beberapa studi pengajaran yang ada hanya fokus terhadap Polychaeta dalam fungsi peranannya sebagai kumpulan makrobenthik (Fauchald, 1977; Pearson and Rosenberg, 1978; Levin, 2003; Yokohama, 2002; Rosenberg, 2002; DeRoach *et al.,* 2002). Hal ini terutama dikarenakan hewan ini tersebut menempati di hampir sebagian besar dari keseluruhan wilayah benthik perairan laut dan

3

Interaksi Makrobenthos dan Struktur Sedimen

3.1 HIDRODINAMIKA PERAIRAN DAN STRUKTUR SEDIMEN

Sedimen komposisi, terutama liat, lempung, dan pasir halus merupakan faktor penting dalam menyusun komunitas makrobenthos.Materi organik sebagai sumber makanan utama untuk hewan invertebrata laut juga berperan penting dalam menentukan struktur makrobenthos. Faktor-faktor lain, seperti sifat-sifat kimia air, kelimpahan dan komposisi mikrobia yang dapat mempengaruhi strukturnya. Faktor-faktor tersebut dari waktu ke waktu dapat bervariasi, baik kualitas maupun kuantitasnya, bergantung pola hidrodinamika setempat.

Komposisi sedimen dikontrol terutama oleh kekuatan hidrodinamika perairan setempat (Snelgrove and Butman, 1994). Lingkungan dengan energi yang kuat umumnya dicirikan oleh arus dasar perairan yang kuat, pertukaran makanan secara horizontal yang kuat, sedimen berpasir kasar, dan kandungan organik dan mikrobia yang rendah. Sebaliknya, pada sedimen berlumpur dan berliat, pertukaran makanan secara horizontal lemah, tapi pertukaran vertikalnya kuat merupakan karakteristik untuk lingkungan berenergi lemah (Dernie *et al.*, 2003; Snelgrove and

5

Penggunaan Struktur Makrobenthos dalam Penerapan Manajemen Lingkungan: Studi Kasus di Danau Rawapening

5.1 POTENSI PERIKANAN BUDIDAYA INDONESIA

Indonesia merupakan negara maritim dan kepulauan terbesar di dunia, dengan luas 5,8 juta kilometer persegi (km) atau 2/3 luas wilayah Republi Indonesia (RI) dan panjang pantai sekira 95.181 km. Salah satu sumber-sumber pertumbuhan ekonomi baru Indonesia yang dapat dikembangkan untuk kemajuan dan kesejahteraan adalah perikanan budidaya. Namun demikian, PDB (produk domestik bruto) perikanan RI baru 3,46 persen (Sudarsono, 2012). Lebih lanjut, berdasarkan data statistik perikanan budidaya tahun 2012, hanya sekitar 30 persen dari total produksi adalah komoditas ikan dan udang, sedangkan 70 persen lainnya adalah produksi rumput laut (Direktorat Jenderal Perikanan Budidaya, Kementerian Kelautan dan Perikanan, 2013). Sedangkan produksi perikanan budidaya di Jawa Tengah sepanjang kuartal I/2013 meningkat 0,8% dibanding sebelumnya, yaitu 50.369 ton ikan melalui lima jenis budidaya perikanan, antara lain budidaya tambak, kolam, karamba, karamba jaring apung dan budidaya sawah (Nastiti, 2013). Pada 2010, berdasarkan jumlah total produksinya, Indonesia menjadi negara keempat dalam hal produksi budidaya ikan non rumput laut

APPENDIX L

LIST OF TAXONOMY REFERENCES USED IN IDENTIFIACTION OF BENTHOS

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