ΕΚΘΕ
ΕΘΝΙΚΟ ΚΕΝΤΡΟ ΘΑΛΑΣΣΙΩΝ ΕΡΕΥΝΩΝ
NATIONAL CENTRE FOR MARINE RESEARCH

ΜΟΝΟΓΡΑΦΙΕΣ ΘΑΛΑΣΣΙΩΝ ΕΠΙΣΤΗΜΩΝ
MONOGRAPHS ON MARINE SCIENCES

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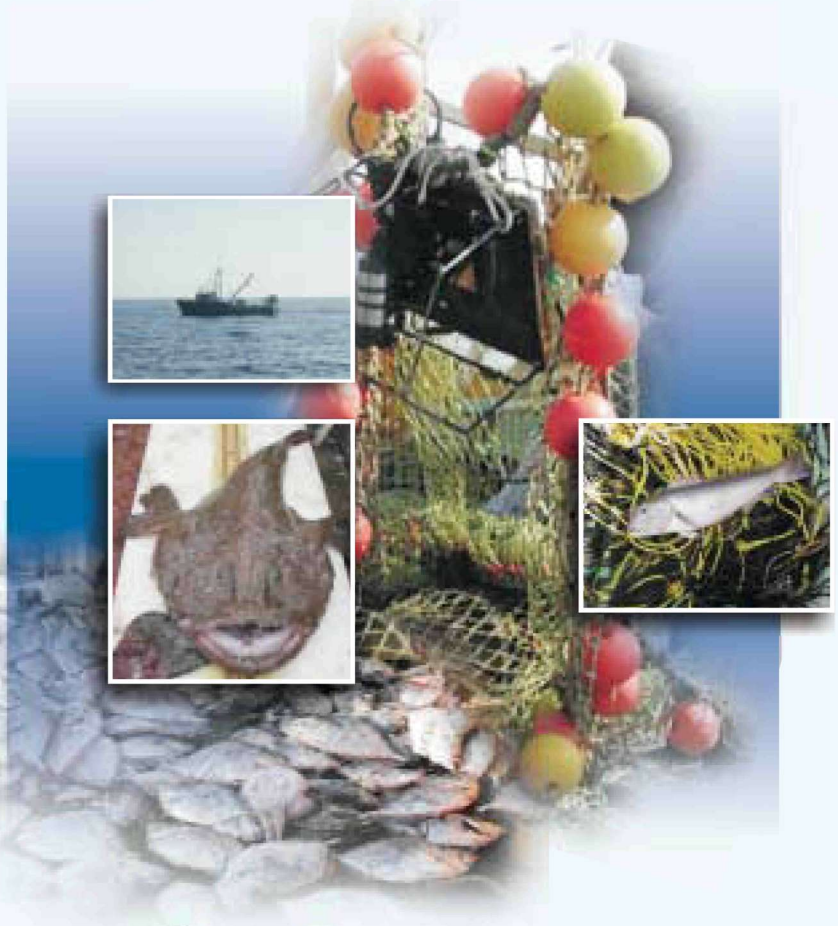

Κώστας Παπακωνσταντίνου
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Καθορισμός Προδιαγραφών Συστήματος Παρακολούθησης Αλιευτικών Αποθεμάτων

Developing of the Specifications of a Monitoring System for Fisheries Resources

ΑΘΗΝΑ 2002
ATHENS 2002

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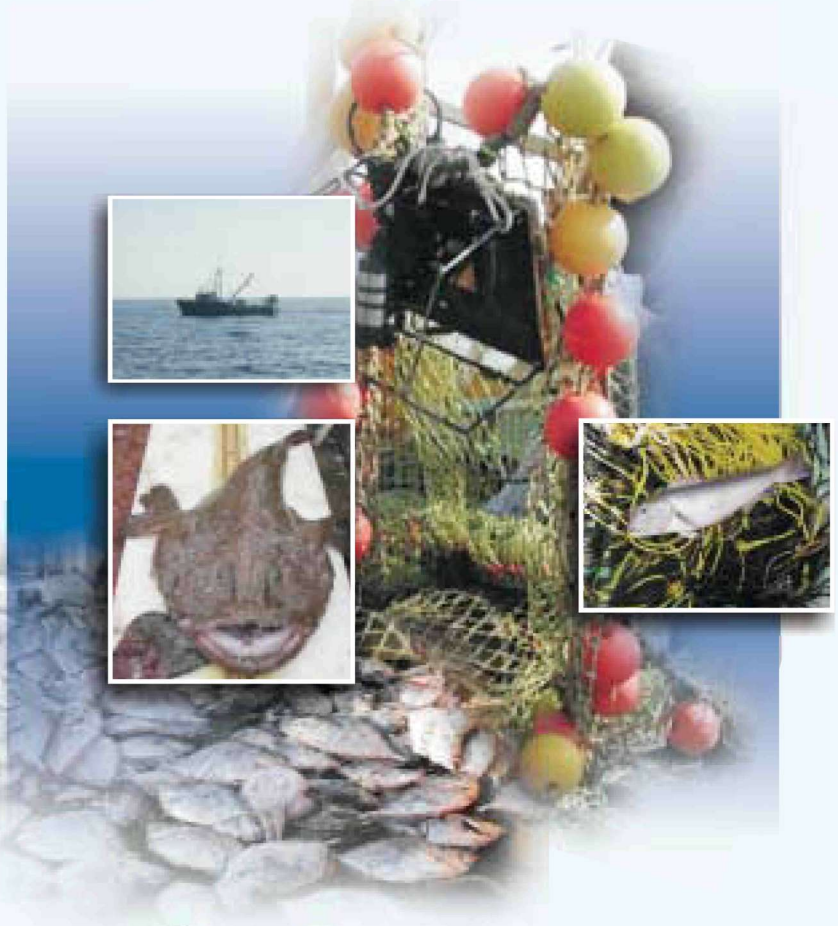

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ΠΕΡΙΕΧΟΜΕΝΑ

Π Ρ Ο Λ Ο Γ Ο Σ

Το παρόν βιβλίο βασίστηκε στην ανάγκη να οργανωθεί στη χώρα μας ένα εθνικό σύστημα παρακολούθησης των αλιευτικών πόρων της. Εν τω μεταξύ, εκδόθηκε από την Ε.Ε. ο Κανονισμός 1543/2000 ή τροποποιήθηκαν ήδη υπάρχοντες κανονισμοί, π.χ. 2846/98, οι οποίοι έθεσαν το όλο εγχείρημα σε νέα διάσταση, επειδή οι κανονισμοί αυτοί περιγράφουν λεπτομερώς τις ανάγκες ενός ολοκληρωμένου συστήματος συλλογής βιολογικών και οικονομικών στοιχείων, τις υποχρεώσεις του κράτους μέλους και των συμμετεχόντων φορέων στα προγράμματα, τον προϋπολογισμό τους, κ.λπ. Για το λόγο αυτό, κρίθηκε σκόπιμο από το συγγραφέα να επεκτείνει την πραγματεία του και να περιλάβει, εκτός από εκείνα που αναφέρονται στους κανονισμούς, και ορισμένα επιπλέον κεφάλαια τα οποία θα βοηθήσουν την καλύτερη κατανόηση του προβλήματος που παρουσιάζει η σύνταξη ενός προγράμματος συλλογής αλιευτικών στοιχείων.

Στο **πρώτο κεφάλαιο** περιγράφονται οι γενικές αρχές που πρέπει να καθορίζουν ένα σύστημα παρακολούθησης αλιευτικών πόρων, λεπτομερής οδηγός για τη συγκέντρωση των κατάλληλων στατιστικών αλιευτικών στοιχείων, οι κατάλληλες δειγματοληψίες και επισκοπήσεις που πρέπει να οργανωθούν, τα προβλήματα της πολυειδικής αλιείας τα οποία είναι ιδιαίτερα σύνθετα στη Μεσόγειο, τα σπουδαιότερα λάθη δειγματοληψίας και η αποφυγή τους και, τέλος, ο ορισμός της γεωγραφικής μονάδας αλιευτικής διαχείρισης.

Στο **δεύτερο κεφάλαιο** περιγράφεται η υπάρχουσα κατάσταση των διαφόρων στατιστικών αλιείας της χώρας, όπως της ΕΣΥΕ, της ΕΤΑΝΑΛ, της Αγροτικής Τράπεζας και των υπαρχόντων βιολογικών στοιχείων που έχουν συγκεντρώσει τα ερευνητικά ιδρύματα τα τελευταία χρόνια στα πλαίσια διαφόρων κοινοτικών, ως επί το πλείστον, προγραμμάτων.

Στο **τρίτο κεφάλαιο** περιγράφονται τα συστήματα συλλογής αλιευτικών στοιχείων που εφαρμόζονται στη χώρα ή πρόκειται να εφαρμοστούν βάσει των κανονισμών της Ε.Ε. (2847/93/12.10.93, 2846/98/17.12.98 και 1543/2000/ 29.06.00).

Στο **τέταρτο κεφάλαιο** προτείνονται διάφορα ολοκληρωμένα συστήματα συγκέντρωσης αλιευτικών στοιχείων που στοχεύουν στη συλλογή:

- βιολογικών στοιχείων με τα σπουδαιότερα αλιευτικά εργαλεία που ψαρεύουν στη χώρα,
- στοιχείων αλιευτικής προσπάθειας που συγκεντρώνονται είτε με τη μέθοδο των παρατηρητών επί του σκάφους είτε με τη μέθοδο των τοπικών ανταποκριτών,
- αλιευτικών στοιχείων που συλλέγονται με τη μέθοδο του βιβλίου ή πινακίου αναφοράς αλιευμάτων (log book),
- βιολογικών στοιχείων και αλιευτικής προσπάθειας που συγκεντρώνονται από τις εκφορτώσεις, καθώς, και σε
- ορισμένες σκέψεις για την οργάνωση ενός συστήματος παρακολούθησης των τιμών των αλιευτικών προϊόντων.

Τέλος, στο **πέμπτο κεφάλαιο** προτείνεται το οργανόγραμμα ενός ολοκληρωμένου συστήματος παρακολούθησης των αλιευτικών πόρων της χώρας, βασισμένο στο σύνολο των αλιευτικών στοιχείων που θα συλλέγονται με τα προτεινόμενα σχήματα.

Σεπτέμβριος 2002

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ABSTRACT

The first chapter describes the general principles that should characterize and describe a system for the monitoring of fisheries resources, the detailed directions for the collection of the suitable statistical information, the required samplings and reviews that should be organized on the basis of those principles, the problems of multi-species fishery - which are particularly complex in the Mediterranean, the rationale for selecting suitable sampling design, the major sources of sampling biases and how they could be possibly reduced and, finally, the implementation of geographic unit in fisheries management and the advantages of its use in the Mediterranean.

The second chapter describes the existing fisheries statistics and databases in the country, such as the National Statistical Service of Greece, the Fishery Development Corporation, the Agricultural Bank of Greece, as well as other data sources coinciding mainly with the research institutes of the country and gathered in the recent years within the frame of various, mainly EU, research projects.

The third chapter describes the routines of fisheries data collections that are applied in our country now days or will be applied in the future in accordance to the existing EU regulations (2847/93/12.10.93, 2846/98/17.12.98 and 1543/00/29.06.00).

In the fourth chapter a comprehensive system of collection of fisheries data is described that aims in gathering (a) biological information on the major target fishes collected with the main fishing gears used in the country, (b) data on fishing effort of the main fishing gears through either on board sampling or by reports of local observers, (c) fisheries data collected from the log books, and (d) biological data and fishing effort from the landings. The above features are considered prerequisite while organizing a data collection system focusing on the rational and holistic management of fisheries resources of the Greek seas.

Finally, in the fifth chapter an Integrated System of Fisheries Resources Monitoring (ISFReM) for the country is proposed, based on the full amount of fisheries data that will be gathered through the aforementioned comprehensive data collection system. The Greek research institutes will contact the appropriate data collection and the user of ISFReM will be the General Directorate of Fishery of the Ministry of Agriculture, responsible for the application of fishery policy in the country.

ΠΕΡΙΛΗΨΗ

Υπάρχουν πολλοί λόγοι που καθιστούν δύσκολή την εκτίμηση των ιχθυοαποθεμάτων και τη διαχείρισή τους στη Μεσόγειο. Ένας από τους σπουδαιότερους λόγους είναι η έλλειψη ολοκληρωμένων διοικητικών δομών που να ασχολούνται με όλα τα στάδια της διαχείρισης των βιολογικών πόρων των κρατών της περιοχής. Εκτός αυτού υπάρχουν και άλλοι λόγοι που καθιστούν δύσκολη την ορθολογική διαχείριση των αλιευτικών πόρων της Μεσογείου, όπως ο μεγάλος αριθμός ειδών που αποτελούν αλιευτικούς στόχους, η δυσκολία στη δειγματοληψία εμπορεύσιμων αλιευμάτων, ο μεγάλος αριθμός λιμανιών εκφόρτωσης, η μεγάλη ποικιλία αλιευτικών τεχνικών, ο μεγάλος αριθμός μικρών σκαφών που ανήκουν στην παράκτια αλιεία, η αναγκαιότητα επιμόρφωσης των επιστημόνων που ασχολούνται με την αλιεία, αλλά και οι διαφορετικές προτεραιότητες των διαφόρων κρατών της περιοχής. Η έλλειψη των παραπάνω πληροφοριών αποτελεί λόγο για την περιορισμένη ανάπτυξη της αλιευτικής έρευνας στη Μεσόγειο, αλλά και στη χώρα μας, με αντίστοιχη δυσκολία στη διαχείριση των αλιευτικών πόρων. Απαραίτητη, όμως, προϋπόθεση για την αλιευτική διαχείριση είναι η συλλογή κατάλληλων αλιευτικών στοιχείων τα οποία συγκεντρώνονται με εξειδικευμένες μεθόδους δειγματοληψίας, ώστε να αντιπροσωπεύουν όσο μπορούν περισσότερο την αλιευτική κατάσταση της περιοχής δειγματοληψίας. Έτσι, είναι επιβεβλημένη η αναγκαιότητα σύνταξης και εφαρμογής ενός εθνικού προγράμματος συλλογής αλιευτικών στοιχείων στη χώρα μας, το οποίο θα είναι εναρμονισμένο με αντίστοιχα προγράμματα των άλλων κρατών της Μεσογείου και θα στοχεύει στην ορθολογική και ολιστική διαχείριση των αλιευτικών πόρων της.

Η μελέτη της αλιείας η οποία χαρακτηρίζεται από τη χρήση πολλών και διαφορετικών σκαφών, αλιευτικών εργαλείων και στοχεύει σε πολλά και διαφορετικά είδη ψαριών, εμφανίζει πολλές δυσκολίες σ'όλα τα επίπεδα. Οι δυσκολίες αυτές συνοψίζονται ως προβλήματα: α) καθορισμού διαχειριστικών στόχων, β) απουσίας εφαρμογής απλών μοντέλων και γ) δυσκολίας στην λήψη αποφάσεων, εξαιτίας των πολλών δεδομένων υψίστης προτεραιότητας που πρέπει να συγκεντρωθούν σε σχέση με το περιορισμένο ανθρώπινο δυναμικό που συνήθως διατίθεται για τη συγκέντρωση των πληροφοριών αυτών. Το γεγονός ότι εκτός των βιολογικών στοιχείων είναι απαραίτητος και ένας μεγάλος αριθμός οικονομικών στοιχείων για την κατανόηση της αλιείας, λαμβανομένου υπόψη ότι η αλιεία δεν αποτελεί μόνο βιολογική διαδικασία αλλά, κυρίως, οικονομική, καθιστά το όλο εγχείρημα περισσότερο σύνθετο. Τα βασικά στοιχεία που είναι απαραίτητα για την αλιευτική διαχείριση είναι: α) η αλιευτική παραγωγή, β) ο αλιευτικός στόλος, γ) η αλιευτική προσπάθεια, δ) ορισμένοι βιολογικοί παράμετροι των ειδών στόχων, και δ) εκείνα που περιγράφουν την οικονομική και κοινωνική κατάσταση των αλιέων.

Στη συνέχεια καταβάλλεται σημαντική προσπάθεια στην περιγραφή των γενικών αρχών συλλογής των αλιευτικών στοιχείων, η οποία καθορίζεται από τη διάθεση του απαραίτητου ανθρώπινου δυναμικού, την ικανοποιητική περιγραφή της κατάστασης των αλιευτικών πόρων, την εκτίμηση της οικονομικής αποδοτικότητας του αλιευτικού τομέα και τον υπολογισμό του «κέρδους» του ψαρά. Τα στοιχεία αυτά στην αλιεία είναι πολυποίκιλα και καλύπτουν το σύνολο των απαραιτήτων πληροφοριών για την κατανόηση και διαχείριση του τομέα. Οπωσδήποτε, όμως, η επιτυχία της προσπάθειας αυτής συνδυάζεται με τον καθορισμό της πολιτικής και της στρατηγικής που θα ακολουθηθεί για τη συλλογή των στατιστικών στοιχείων, γεγονός που καθιστά απαραίτητο την οργάνωση ενός σχεδίου επισκόπησης, την εκτίμηση της αλιευτικής παραγωγής με διαφορετικές μεθόδους, τη διερεύνηση πηγών συλλογής αλιευτικών στοιχείων που εξυπηρετούν άλλες χρήσεις, τη χαρτογράφηση των πηγών συλλογής των αλιευτικών στοιχείων και τέλος τη στατιστική προσέγγιση της επισκόπησης σε ποιοτικό και χωροταξικό επίπεδο.

Μεγάλος αριθμός μαθηματικών μοντέλων, τα οποία απαιτούν σημαντικό αριθμό βιολογικών παραμέτρων όπως αλιευτική παραγωγή και προσπάθεια, ηλικία, αύξηση, θνησιμότητα κλπ, είναι διαθέσιμα για την εκτίμηση της κατάστασης των ιχθυοαποθεμάτων και τη διαχείρισή τους, ενώ πολλά μοντέλα που εφαρμόζονται σήμερα, λαμβάνουν υπόψη και τις κλιματολογικές αλλαγές. Η Αλιευτική Παραγωγή ανά Μονάδα Αλιευτικής Προσπάθειας (ΠΑΜΑΠ) είναι ένας ιδιαίτερα σημαντικός δείκτης της αφθονία και συγχρόνως καθορίζει το επίπεδο αλιείας του πόρου. Στη συνέχεια αναλύεται η σημασία που έχουν στην αλιευτική διαχείριση τα απορριπτόμενα αλιεύματα, η κατά είδος και μήκος σύνθεση του αλιεύματος, η οριοθέτηση της περιοχής αλιείας και ο καθορισμός της ομάδας αποθέματος, η χρονική διάρκεια αλιείας, η εκτίμηση της ΠΑΜΑΠ, της αλιευτικής προσπάθειας και του χρόνου αλιείας των διαφορετικών αλιευτικών εργαλείων.

Η συλλογή των στοιχείων της αλιευτικής παραγωγής και προσπάθειας βασίζεται στο σχεδιασμό κατάλληλης επισκόπησης, για την οργάνωση της οποίας θα πρέπει να ληφθούν υπόψη τα ακόλουθα: α) καθορισμός αντικειμένου ή εξειδίκευση του σκοπού της επισκόπησης, β) γεωγραφική κάλυψη ή οριοθέτηση του πληθυσμού και κατηγορίες των παραμέτρων που θα καλύψει (π.χ. είδη, αλιευτικές τεχνικές), γ) τύποι πληροφοριών που θα συλλεγούν, βαθμός

υποδιαίρεσης των στοιχείων, μέθοδοι μέτρησης δ) οργάνωση μεθόδων συλλογής των στοιχείων, ε) επιλογή καταλλήλου δειγματοληπτικού πλαισίου και οργάνωσή του σε περίπτωση που δεν έχει γίνει, και στ) επιλογή της μονάδας δειγματοληψίας και τύπο του δείγματος (π.χ. στρωματοποιημένο, σε πολλά επίπεδα), καθορισμό του μεγέθους του και μέθοδοι επιλογής του. Το γεγονός ότι η παραπάνω επισκόπηση καλείται να καλύψει πολυειδική αλιεία, όπως είναι η Μεσογειακή αλιεία, καθιστά το όλο εγχείρημα περισσότερο πολύπλοκο.

Η αλιεία έχει και σημαντική οικονομικο-κοινωνική διάσταση με αποτέλεσμα να είναι απαραίτητος ο σχεδιασμός επισκοπήσεων που στοχεύουν στη συλλογή οικονομικών και κοινωνικών αλιευτικών στοιχείων. Ανάμεσα στις δυσκολίες καθορισμού των οικονομικών στοιχείων που απαιτούνται για την αλιευτική διαχείριση είναι η αδυναμία εφαρμογής των μέτρων ή των παρεμβάσεων που την ενισχύουν και η διαφοροποίησή της από τις αναπτυξιακές δραστηριότητες. Για να ξεπεραστούν οι δυσκολίες αυτές η αλιευτική διαχείριση θα βασιστεί σε κατάλληλες πληροφορίες, οι οποίες μετά τη συλλογή και αξιολόγησή τους θα προτείνουν διαχειριστικές παρεμβάσεις, οι οποίες θα αξιολογηθούν μετά από ικανό χρονικό διάστημα, τόσο ως προς το αποτέλεσμά τους, όσο και ως προς το κόστος τους και τον χρόνο και την ακρίβεια του επιτευχθέντος στόχου. Τα απαραίτητα στοιχεία που πρέπει να συγκεντρώνονται σε μία οικονομικό-κοινωνική επισκόπηση είναι τα ακόλουθα: α) δομή του στόλου, β) αλιευτική δραστηριότητα, γ) οικονομικά δεδομένα της αλιευτικής παραγωγής, δ) εργατικό δυναμικό και ε) εμπορία. Μερικά από τα στοιχεία αυτά πρέπει να συγκεντρώνονται σε μόνιμη βάση με κατάλληλες χρονο-χωρικές επισκοπήσεις, ενώ άλλα ευκαιριακά, ανάλογα με τις παρεμβάσεις στον κλάδο.

Την τελευταία δεκαετία πολλοί διεθνείς οργανισμοί που ασχολούνται με τη διαχείριση των αλιευτικών πόρων έχουν εισαγάγει στην αλιευτική διαχείριση την έννοια της γεωγραφικής μονάδας αλιευτικής διαχείρισης (management unit) η οποία στοχεύει, συνήθως, στον καθορισμό κανόνων διαχείρισης των διασυνοριακών ιχθυοαποθεμάτων που κυρίως απαντούν σε διεθνή νερά. Στα πλαίσια του καθορισμού των γεωγραφικών μονάδων αλιευτικής διαχείρισης για την Μεσόγειο Θάλασσα, η Επιστημονική Συμβουλευτική Επιτροπή (SAC) του Γενικού Συμβουλίου για την Αλιεία της Μεσογείου (GFCM/FAO) αποφάσισε όπως οι γεωγραφικές μονάδες αλιευτικής διαχείρισης θα πρέπει να εμφανίζουν τις ακόλουθες προϋποθέσεις: α) να είναι διαφορετική η διαχειριστική τους δράση, χωρίς όμως αυτό να είναι απαραίτητο, β) να είναι διαθέσιμη ή να αποτελεί άμεση προτεραιότητα διερεύνησης η επιστημονική πληροφόρηση της κατάστασης των ιχθυοαποθεμάτων τους, και γ) το SAC να είναι σε θέση να δώσει συγκεκριμένη διαχειριστική πληροφόρηση. Οι ελληνικές θάλασσες καταλαμβάνουν τρεις γεωγραφικές μονάδες αλιευτικής διαχείρισης που χωροθετούνται μία στο Ιόνιο, μία στο Αιγαίο πέλαγος και μία άλλη γύρω από την Κρήτη.

Στην Ελλάδα οι στατιστικές της θαλάσσιας αλιείας συλλέγονται από τρεις οργανισμούς: α) την Εθνική Στατιστική Υπηρεσία (ΕΣΥΕ), β) την Εταιρεία Ανάπτυξης της Αλιείας (ΕΤΑΝΑΛ) και γ) την Αγροτική Τράπεζα της Ελλάδος (ΑΤΕ). Οι επισκοπήσεις είναι ανεξάρτητες με αποτέλεσμα τα στοιχεία που συγκεντρώνονται δεν είναι συγκρίσιμα μεταξύ τους. Η ΕΣΥΕ έχει οργανώσει ένα σύστημα συλλογής αλιευτικών στοιχείων σε εθνική κλίμακα και για τον σκοπό αυτό συνεργάζεται με το Υπουργείο Γεωργίας, τα Λιμεναρχεία, τα τοπικά τελωνεία και αντιπροσώπους της σε δήμους και κοινότητες. Η βασική προτεραιότητα του συστήματος είναι η συλλογή στοιχείων αλιευτικής παραγωγής και απασχόλησης, αλλά ο αλιευτικός στόλος είναι που χρησιμοποιείται για την εκτίμηση της αλιευτικής παραγωγής. Για τη συλλογή των στοιχείων τα χωρικά νερά έχουν χωριστεί σε 16 περιοχές και δύο περιοχές εκτός Ελλάδος. Αναφορικά με τα αλιευτικά εργαλεία διακρίνονται τέσσερις κατηγορίες: α) συρόμενα εργαλεία μηχανότρατας, β) κυκλικά δίχτυα γρι-γρι, γ) πεζότρατες και δ) άλλα παράκτια εργαλεία (σταθερά δίχτυα, παραγάδια, μικρά κυκλικά, βολκοί κ.λπ). Με βάση τα παραπάνω κριτήρια η αλιεία χωρίζεται σε τρεις κατηγορίες: α) Υπερπόντια ή Ατλαντική, που εξασκείται με μηχανότρατα εκτός Μεσογείου, β) Μέση Αλιεία που εξασκείται με μηχανότρατα και γρι-γρι εντός των χωρικών υδάτων, και γ) Παράκτια Αλιεία. Αναφορικά με την αλιευτική παραγωγή περιλαμβάνει τέσσερις βιολογικές κατηγορίες: α) ψάρια, β) κεφαλόποδα, γ) καρκινοειδή και δ) πελεκύποδα. Τέλος, η παραγωγή διαιρείται σε τρεις ποιοτικές κατηγορίες: α) πρώτη, β) δεύτερη και γ) τρίτη.

Στο πλαίσιο των επισκοπήσεων της ΕΣΥΕ λαμβάνουν χώρα τέσσερις στατιστικές επισκοπήσεις, η κάθε μία από τις οποίες στοχεύει σε διαφορετικό τμήμα του στόλου: α) Θαλάσσια Αλιεία - Επισκόπηση 1 (ΘΑΕ-1), καλύπτει τις δραστηριότητες των μηχανοκινήτων θαλασσίων αλιευτικών σκαφών με μηχανή >20HP που ψαρεύουν στα ελληνικά χωρικά ύδατα και στη Μεσόγειο, β) Θαλάσσια Αλιεία - Επισκόπηση 2 (ΘΑΕ-2), καλύπτει τις δραστηριότητες των μηχανοκινήτων θαλασσίων αλιευτικών σκαφών με μηχανή <19HP που ψαρεύουν πλησίον των ακτών, γ) Θαλάσσια Αλιεία - Επισκόπηση 3 (ΘΑΕ-3), καλύπτει τις δραστηριότητες των μη μηχανοκινήτων αλιευτικών σκαφών (κωπήλατα σκάφη) που ψαρεύουν πλησίον των ακτών, και δ) Υπερπόντια Θαλάσσια Αλιεία (ΘΑΕ-0), καλύπτει τις δραστηριότητες των αλιευτικών σκαφών που ψαρεύουν έξω από τη Μεσόγειο. Στο κείμενο περιγράφεται αναλυτικά ο σχεδιασμός, η κάλυψη, η πινακοποίηση και το ποιοτικό προφίλ εκάστης από τις παραπάνω επισκοπήσεις.

Η ΕΤΑΝΑΛ είναι μία μη κερδοσκοπική εταιρεία υπό κρατικό έλεγχο που έχει ιδρυθεί από το Υπουργείο Γεωργίας,

την ΕΤΒΑ και την Αγροτική Τράπεζα για να αναλάβει δραστηριότητες που ενισχύουν την ανάπτυξη της αλιείας. Η ΕΤΑΝΑΛ, μεταξύ των δραστηριοτήτων της διαχειρίζεται τις δέκα ιχθυόσκαλες της χώρας και είναι υποχρεωμένη από τον ιδρυτικό της νόμο να συγκεντρώνουν στατιστικά στοιχεία των αλιευτικών εκφορτώσεων και των μεταφερομένων αλιευμάτων μέσω αυτών των αγορών και να τα γνωστοποιούν κάθε μήνα στους ενδιαφερομένους οργανισμούς. Για την υλοποίηση αυτών των υποχρεώσεων η ΕΤΑΝΑΛ έχει οργανώσει ένα διοικητικό σύστημα που βασίζεται σε απ΄ευθείας μετρήσεις των διακινουμένων αλιευμάτων μέσω των ιχθυοσκαλών. Στους πίνακες της ΕΤΑΝΑΛ τα αλιεύματα κατατάσσονται ανάλογα με την προέλευσή τους σε τέσσερις κατηγορίες: α) ελληνικά, β) μεσογειακά, γ) ατλαντικού, και δ) εσωτερικών υδάτων, ανάλογα με την φρεσκότητά τους σε δύο: α) φρέσκα και β) κατεψυγμένα. Τέλος, καταγράφεται και η ποιοτική τους αξία (κατηγορία Α, Β και Γ). Στο κείμενο περιγράφεται αναλυτικά ο σχεδιασμός, η κάλυψη, η πινακοποίηση και το ποιοτικό προφίλ της επισκόπησης.

Η Αγροτική Τράπεζα στο πλαίσια των δραστηριοτήτων της είχε οργανώσει ένα σύστημα συλλογής στοιχείων της πρωτογενούς παραγωγής, ανάμεσα στα οποία και αλιευτικά. Τα κριτήρια της ΑΤΕ για την ταξινόμηση των αλιευτικών σκαφών λαμβάνουν υπόψη τους την περιοχή που αλιεύουν και τα λειτουργικά χαρακτηριστικά τους, έτσι διακρίνονται έξι μεγάλες αλιευτικές κατηγορίες, προσαυξημένη με εκείνη των υδατοκαλλιεργειών: α) παράκτια, β) μέση, γ) μεσογειακή, δ) ατλαντική, ε) σπογγαλιεία, και στ) εσωτερικών υδάτων. Τα κριτήρια της ΑΤΕ που αναφέρονται στην παραγωγή στηρίζονται στην προέλευση (θάλασσα, λιμνοθάλασσες, ιχθυοκαλλιέργειες), στη φρεσκότητα (φρέσκα, κατεψυγμένα) στην ταξινόμηση (ψάρια, κεφαλόποδα, καρκινοειδή, σπόγγους) και σε εμπορικά κριτήρια (ποιότητα Α, Β, Γ, Δ). Στο κείμενο περιγράφεται αναλυτικά ο σχεδιασμός, η κάλυψη, η πινακοποίηση και το ποιοτικό προφίλ της επισκόπησης. Η ΑΤΕ σταμάτησε τη συλλογή στοιχείων της πρωτογενούς παραγωγής το 1999.

Τα ιχθυοαποθέματα μελετούνται από τα ερευνητικά ινστιτούτα της χώρας στο πλαίσιο πολυετών ερευνητικών προγραμμάτων που χρηματοδοτούνται από εθνικούς, αλλά κυρίως, από κοινοτικούς πόρους. Τα βενθοπελαγικά αποθέματα της χώρας μελετήθηκαν κυρίως από το Εθνικό Κέντρο Θαλασσίων Ερευνών (ΕΚΘΕ), ενώ τα πελαγικά από το Ινστιτούτο Θαλάσσιας Βιολογίας της Κρήτης (ΙΘΑΒΙΚ). Το πρόγραμμα MEDITS είναι ένα διεθνές πρόγραμμα συλλογής βιολογικών δεδομένων για τα βενθοπελαγικά ψάρια της Μεσογείου που αλιεύονται με μηχανότρατα που διεξήχθηκε από το 1993 μέχρι το 2001 και χρηματοδοτήθηκε από την ΕΕ. Το πρόγραμμα εντάχθηκε στον Κανονισμό της ΕΕ 1543/200 και συνεχίζεται. Στο πρόγραμμα αυτό εκτός από τα τέσσερα κοινοτικά κράτη της Μεσογείου, συμμετείχαν και η Αλβανία, Κροατία, Σλοβενία και στο τέλος η Μάλτα, το Μαρόκο και η Τυνησία. Στην Ελλάδα εκτός από το ΕΚΘΕ και το ΙΘΑΒΙΚ στο πρόγραμμα συμμετέχει και το Ινστιτούτο Αλιευτικής Έρευνας (ΙΝΑΛΕ/ΕΘΙΑΓΕ). Στοιχεία απαραίτητα για την ορθολογική διαχείριση των ελληνικών αλιευτικών πόρων έχουν συγκεντρωθεί στο πλαίσιο και διαφόρων άλλων δειγματοληψιών που αναφέρονται στα απορριπτόμενα είδη, στην επιλεκτικότητα των αλιευτικών εργαλείων, στην παράκτια αλιεία, στην αλιευτική προσπάθεια της μέσης αλιείας, στην εκτίμηση της αφθονίας των μεγάλων πελαγικών. Τέλος, υπάρχει μικρός αριθμός οικονομικών στοιχείων που αναφέρονται κυρίως στο εσωτερικό και εξωτερικό εμπόριο, καθώς επίσης και στις τιμές των αλιευτικών προϊόντων.

Το Εθνικό Σύστημα Δειγματοληψίας Αλιευτικής Προσπάθειας (ΕΣΔΑΠ) αποτελεί σημαντική προσπάθεια του ΙΘΑΒΙΚ να οργανώσει ένα σύστημα συλλογής δεδομένων αλιευτικής προσπάθειας. Το πρόγραμμα που άρχισε το 1995 χρηματοδοτήθηκε από διαφορετικά εθνικά και κοινοτικά ερευνητικά προγράμματα. Η επισκόπηση του ΕΣΔΑΠ καλύπτει συλλογή και ανάλυση διαφόρων στοιχείων, όπως: α) αλιευτικής προσπάθειας επιλεγμένων αλιευμάτων της εμπορικής αλιείας, β) αλιευτικού ζήλου, και γ) κοινωνικό-οικονομικών στοιχείων. Τα στοιχεία αυτά αναφέρονται στις σημαντικότερες αλιευτικές τεχνικές που εφαρμόζονται στη χώρα, όπως μηχανότρατα, γρι-γρι και παράκτια αλιεία (δίχτυα, παραγάδια). Στο κείμενο περιγράφεται αναλυτικά η γεωγραφική και χρονική στρωμάτωση της επισκόπησης, ο αριθμός των ειδών που περιλαμβάνει, η πινακοποίηση, το ποιοτικό προφίλ της, καθώς και τα στοιχεία που αναφέρονται στην απασχόληση του αλιεργατικού δυναμικού.

Η θέσπιση συστημάτων ελέγχου της Κοινής Αλιευτικής Πολιτικής (ΚΑΠ) αποτελεί σημαντική προτεραιότητα της ΕΕ. Για να επιτύχει το στόχο του το σύστημα ελέγχου πρέπει να περιλαμβάνει κανόνες για την παρακολούθηση των μέτρων διατήρησης και διαχείρισης των πόρων, των διαρθρωτικών μέτρων και των μέτρων που αφορούν την κοινή οργάνωση της αγοράς, καθώς και ορισμένες διατάξεις για την αντιμετώπιση του ενδεχόμενου της μη εφαρμογής των μέτρων αυτών. Απαραίτητη προϋπόθεση για την επιτυχία των στόχων αυτών είναι η παρακολούθηση της αλιευτικής προσπάθειας και της κατάστασης των ιχθυοαποθεμάτων. Στο πλαίσιο υλοποίησης των παραπάνω αρχών η ΕΕ έχει συντάξει σειρά Κανονισμών βάσει των οποίων η παρακολούθηση της αλιευτικής προσπάθειας γίνεται με το βιβλίο αναφοράς αλιευμάτων (log book) το οποίο είναι υποχρεωμένο να συμπληρώνει έκαστο σκάφος. Οι σχετικοί κανονισμοί περιγράφουν αναλυτικά τη διαδικασία παρακολούθησης, καθώς επίσης τη συγκέντρωση και χρήση των στοιχείων της αλιευτικής προσπάθειας και παραγωγής που συγκεντρώνονται από το βιβλίο αναφοράς αλιευμάτων.

Σχετικοί Κανονισμοί της ΕΕ προβλέπουν την αξιολόγηση της κατάστασης των αλιευτικών πόρων και των

οικονομικών συνεπειών της αλιείας στις χώρες της Ένωσης. Προκείμενου να πραγματοποιηθούν οι επιστημονικές αξιολογήσεις είναι απαραίτητο να συγκεντρωθούν τα ανάλογα στοιχεία. Ο Κανονισμός ΚΑΜ (ΕΚ) 1543/2000 θεσπίζει ένα κοινοτικό πλαίσιο για τη συλλογή και διαχείριση των στοιχείων που απαιτούνται για την αξιολόγηση της κατάστασης των αλιευτικών πόρων και του τομέα της αλιείας, την ευθύνη συλλογής των οποίων έχουν τα κράτη μέλη. Ο Κανονισμός περιγράφει με λεπτομέρεια τα στοιχεία που πρέπει να συγκεντρωθούν, καθώς επίσης και ορισμένες μελέτες που πρέπει να προηγηθούν σε εκείνες τις περιοχές που δεν υπάρχουν σχετικά στοιχεία. Στο βιβλίο περιγράφεται επίσης το τελωνειακό καθεστώς συναλλαγών της ΕΕ με Τρίτες χώρες και τα στατιστικά στοιχεία που ανακοινώνονται στην ΕΕ. Η αναφορά αυτή κρίθηκε απαραίτητη γιατί σημαντικός αριθμός αλιευτικών στοιχείων που αναφέρονται κυρίως στην οικονομία της αλιείας συγκεντρώνονται μ'αυτούς τους κανονισμούς.

Στη συνέχεια περιγράφεται αναλυτικά ένα πρόγραμμα συλλογής αλιευτικών στοιχείων, με διαφορετικά αλιευτικά εργαλεία, που στοχεύει στη διαχείριση των αλιευτικών πόρων της χώρας. Η θεωρητική υποδομή του προγράμματος βασίζεται στη μεθοδολογία που αναφέρθηκε σε προηγούμενα κεφάλαια. Το προτεινόμενο πρόγραμμα στοχεύει: α) στην προστασία των ιχθυοπληθυσμών της χώρας, β) στην εισήγηση λήψης ή συμπλήρωση μέτρων για την προστασία της ιχθυοπαραγωγής, γ) στην τεκμηρίωση νέων συστημάτων διαχείρισης, δ) στην αύξηση του εισοδήματος των ψαράδων, και ε) στην προαγωγή της αλιευτικής έρευνας. Η συγκέντρωση των απαραιτήτων αλιευτικών στοιχείων βασίζεται σε μια σύνθετη μεθοδολογία, γιατί πρέπει να συγκεντρώσει και να αναλύσει στοιχεία που προέρχονται από διαφορετικές αλιευτικές τεχνικές, διαχειριστικές γεωγραφικές μονάδες και ιχθυοπληθυσμούς. Το γεγονός ότι τα στοιχεία αυτά θα παρέχουν τη δυνατότητα να περιγράψουν την κατάσταση των ιχθυοπληθυσμών (βενθοπελαγικών, μικρών και μεγάλων πελαγικών), να καταγράψουν την απόδοση των αλιευτικών σκαφών ανά αλιευτική τεχνική, να συλλέξουν πληροφορίες αλιευτικής παραγωγής, προσπάθειας και τιμών αλιευτικών προϊόντων ανά αλιευτική τεχνική και είδος, καθιστά το όλο εγχείρημα ιδιαίτερα πολύπλοκο και δαπανηρό, οπωσδήποτε όμως αναγκαίο για την ορθολογική και ολιστική διαχείριση των αλιευτικών πόρων της χώρας.

Η διαχείριση του τόνου γίνεται στη Μεσόγειο Θάλασσα με ποσόστωση, με αποτέλεσμα να καταστεί εμφανής η αναγκαιότητα οργάνωσης ενός συστήματος το οποίο θα την παρακολουθηθεί. Η παρακολούθηση της αλιείας του τόνου γίνεται με τη μέθοδο του βιβλίου αναφοράς, γεγονός που ανέδειξε τις δυσκολίες εφαρμογής του στη Μεσόγειο. Οι δυσκολίες αυτές επικεντρώνονται στην επιλογή του κατάλληλου στατιστικού μοντέλου συγκέντρωσης του δείγματος, στην οργάνωση του μηχανισμού υποδοχής και ελέγχου των στοιχείων, καθώς επίσης και στην αξιολόγηση και πινακοποίηση των στοιχείων. Στο τέλος του κεφαλαίου περιγράφεται μία ολοκληρωμένη επισκόπηση παρακολούθησης βιολογικών στοιχείων και αλιευτικής προσπάθειας από τις εκφορτώσεις στις ιχθυόσκαλες, το προφίλ του συστήματος συλλογής των στοιχείων της, καθώς επίσης και τα προβλήματα οργάνωσής της.

Στο τελευταίο μέρος του βιβλίου προτείνεται το οργανόγραμμα ενός Ολοκληρωμένου Συστήματος Παρακολούθησης των Αλιευτικών Πόρων για τη χώρα (ΟΣΠΑΠ), βασισμένο στο σύνολο των αλιευτικών στοιχείων που θα συλλέγονται με τα προτεινόμενα σχήματα και θα στοχεύει στην ορθολογική και ολιστική διαχείριση των αλιευτικών πόρων των ελληνικών θαλασσών. Χρήστης του ΟΣΠΑΠ θα είναι ο φορέας εξάσκησης της αλιευτικής πολιτικής της χώρας, δηλαδή η Γενική Δ/νση Αλιείας του Υπουργείου Γεωργίας και φορέας υλοποίησης τα ερευνητικά ιδρύματα της χώρας που δραστηριοποιούνται στην αλιευτική έρευνα και κατέχουν στατιστικά αλιευτικά στοιχεία τα οποία μπορούν να διαθέσουν. Η χρηματοδότηση του συστήματος θα γίνει από το Υπουργείο Γεωργίας. Το ΟΣΠΑΠ αποτελείται από δύο επιστημονικά σώματα, (α) τη Συμβουλευτική Επιτροπή Διαχείρισης Αλιευτικών Πόρων (ΣΕΔΑΠ) που στοχεύει στην παροχή στη Γενική Δ/νση Αλιείας τεκμηριωμένων επιστημονικών συμβουλών που είναι απαραίτητα για την ορθολογική διαχείριση των αλιευτικών πόρων της χώρας και (β) τις Ομάδες Συλλογής και Ανάλυσης Αλιευτικών Στοιχείων (ΟΣΑΑΣ) που στοχεύουν στη συλλογή και ανάλυση των αλιευτικών στοιχείων που συγκεντρώνονται στο πλαίσιο του προγράμματος συλλογής των αλιευτικών στοιχείων.

III.1. THE FISHERIES IN THE MEDITERRANEAN SEA

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INTRODUCTION

The Mediterranean Sea is the largest of the semi-enclosed European Seas. It is surrounded by 18 countries and has shores on three continents (Europe, Africa and Asia) with a coast-line of 46 000 km, where some 129 million people live. It has an average depth of 1.5 km, and more than 20% of the total area is covered by water less than 200 m deep (UNEP, 1989). The sea consists of two major basins, the eastern and the western. There are also smaller regional seas within the Mediterranean such as the Ligurian, Tyrrhenian, Adriatic, Aegean seas. It is linked to the Atlantic by the Straits of Gibraltar, with the Black Sea and Sea of Azov by the Dardanelles, the Sea of Marmara and the Bosphorus, and with the Red Sea through the Suez Canal. The Mediterranean Sea is characterized by low precipitation, high evaporation, high salinity, low tidal action and relatively low nutrient concentrations outside the inner coastal zone and parts of some regional seas.

GENERAL DESCRIPTION OF FISHERIES IN THE MEDITERRANEAN SEA

Mediterranean fishery represents about 23% of the total Community fleet expressed in tonnage and 35% in engine power. In numbers, it represents about 48% of Community fishing vessels. On average, fishing vessels in the Mediterranean are smaller than in the rest of the Community. More than 34 000 vessels, around 80% of the Mediterranean vessels, are smaller than 12 m in length, giving the Mediterranean fleet its characteristics of a small scale artisanal fishery, although a large proportion of the catches is taken by larger, non artisanal vessels[1]. The landings in volume in the Mediterranean represent a relatively modest share of about 12% of total Community landings.

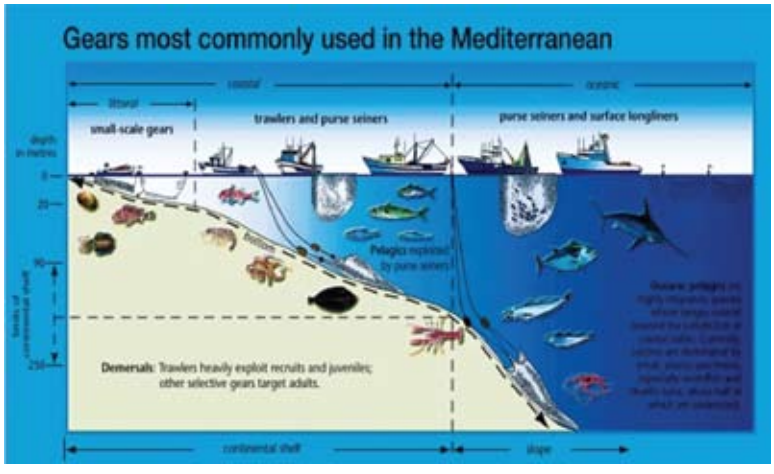

Figure 1: Most commonly used gears in the Mediterranean Sea. Source: www.fao.org.

The fishing fleet

The Mediterranean fisheries can be broken down into three main categories: small scale fisheries, trawling and seining fisheries (Figures 1 and 2). The term "small-scale fisheries", attempting to integrate aspects of the "coastal" and "artisanal" fisheries and to avoid the vagueness, inconsistencies and differences of previous definitions, is virtually absent from the official terminology of most Mediterranean countries. This term was introduced initially in 1990 by the European Commission, when the Commission presented a proposal[2] to amend Regulation 4028/86 on measures to improve and adapt structures in the fisheries and aquaculture sector (Anonymous, 1990).

Most of the trawlers could be considered as semi-industrial or industrial vessels, taking into account the international practice. Trawls are widely used in the Mediterranean and there are two main types: (a) bottom, and (b) pelagic trawlers. Seine nets (purse seines) are one of the main types of fishing gear used in the Mediterranean. The Community Mediterranean fleet represents about 22% of the total Community fleet expressed in tonnage and 34% expressed in engine power. In numbers, it represents about 46% of Community fishing vessels. On average, fishing vessels in the Mediterranean are smaller than in the rest of the Community. More than 32 950 vessels, i.e. around 80% of the Mediterranean vessels, are smaller than 12 m in length, giving the Mediterranean fleet its

1 Fisheries Yearbook 1993-2002, Office for the Official Publication of the European Communities, 2003, ISBN: 92-894-6338-4

2 COM(90) 358 final of 7 September 1990

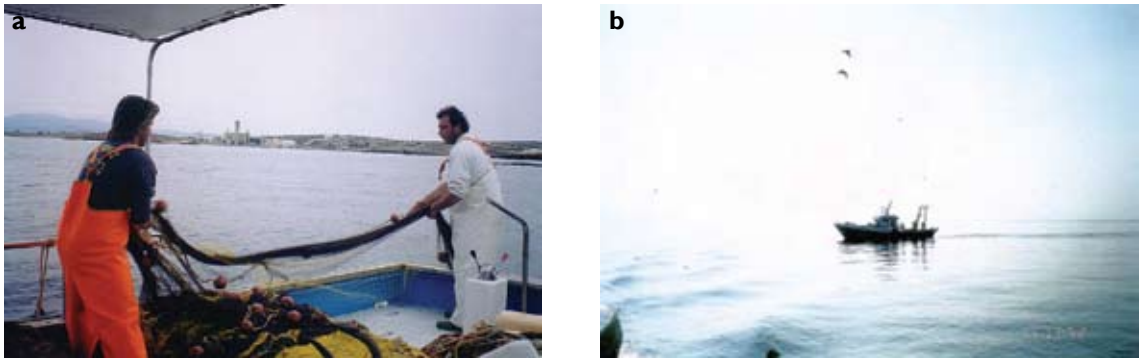

Figure 2: Commercial fishing activities conducted by different fishing vessels: a) artisanal fishery boat, b) trawler. Source: S. GLYKOKKOKALOS.

characteristics of a small-scale artisanal fishery, although a large proportion of the catches is taken by larger, non-artisanal vessels[3].

The fish production

Fishing has a long tradition in Mediterranean countries, and many methods of exploitation of this resource have developed there from ancient times. This historical and cultural background is the reason for the diversity of gears in use, and the significance of so many small-scale fisheries that are found along the Mediterranean seashore.

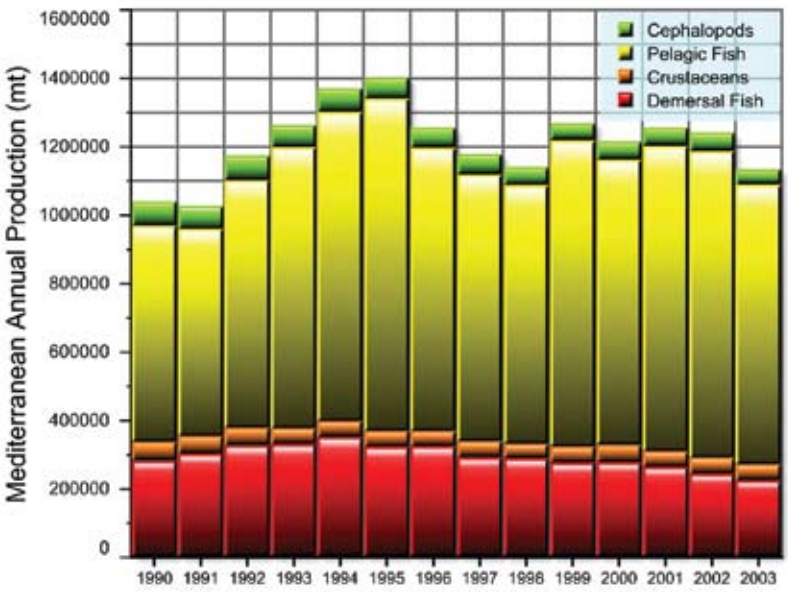

Figure 3: Total annual production of Mediterranean countries. Source data: FAO FISHSTAT database

The total production of capture fisheries in the Mediterranean (all countries included) is illustrated in Figure 3. It can be seen that the cephalopod and crustacean production is almost stable the last 15 years. The demersal fish production shows a decline during the last 10 years probably showing the effects from over-fishing from the medium fishery sector (trawlers and purse seiners). Pelagic fisheries show a fluctuation during the last 15 years and form the largest component of the Mediterranean landings.

The exploited depth range for demersal fisheries in the Mediterranean is usually from 10 to 800 m, but is mainly within 400m for shallower shelf species such as coastal species, e.g. grey mullets, sea breams, sea bass, some shrimps (*Crangon crangon*), and many molluscs. Continental shelf fisheries are usually dominated by red mullets (*Mullus barbatus, Mullus surmuletus*), sole (*Solea solea*), gurnards (*Trigla* sp.), poor cod (*Trisopterus minutus capelanus*), Black Sea whiting (*Merlangius merlangus euxinus*), common spiny lobster (*Palinurus elephas*) and the karamote prawn (*Melicertus kerathurus*). On the continental slope, however, there are many species of economic interest. Thus on the upper slope (200 - 400m) there are hake (*Merluccius merluccius*), flatfishes (*Lepidorhombus boscii, Citharus linguatula*), Norway lobster (*Nephrops norvegicus*) etc., and various shrimps (e.g. *Penaeus longirostris*). In the deeper waters, from 400 to 600m, the dominant species are the greater forkbread (*Phycis blennoides*), the blue whiting (*Micromesistius poutassou*) and the red shrimps (*Aristeus antennatus* and *Aristaeomorpha foliacea*).

3 European Union fleet register

THE STATE OF THE RESOURCES

Demersal and pelagic resources

Mediterranean resources have a long history of biological research (FARRUGIO *et al.,* 1993), but for many countries it is only relatively recently that research has been carried out specifically in support of management of fish populations, and the level of application of research recommendations in the management of marine fisheries is still generally low. Less information on the state of stocks is available for species in the Mediterranean, and fishery landings' trends often provide the only indication of changes that have occurred in the past.

The depletion of inshore resources occurred very quickly after the Second World War, during which stocks in the northern Mediterranean, which had been heavily fished before the war, had recovered in biomass and individual size, due to a reduction of fishing pressure during the period of hostilities. A similar situation was reported in 1993 for the hake populations along the coasts of Croatia during the recent civil wars. These examples also have a hopeful aspect as it suggests that stock levels can recover, once effort levels are reduced, and that a reduction of fishing effort would lead to a rebuilding of stocks.

Periodical updating of the research activities dealing mainly with demersal and small pelagic Mediterranean living resources and fisheries have been realized by the General Fisheries Council for the Mediterranean (GFCM) since 1970, during working group occasions and technical consultations at a regional level. OLIVER (1983) reviewed the fisheries' resources and activities in the western Mediterranean giving information on the state of the stocks, the production, the landings, etc. The scientific knowledge of large pelagic stocks and fisheries is annually updated for more than 20 years by the International Commission for the Conservation of Atlantic Tunas (ICCAT). Furthermore, a detailed review has been prepared for the EU Diplomatic Conference on Fisheries' Management, held in Kriti in 1994 (CADDY, 1999) and in Venice two years later, in 1996 (FARRUGIO, 1996; TSIMENIDES, 1997; PAPACONSTANTINOU AND FARRUGIO, 2000), as well as in the meeting held at Kriti for the Coordination of Fishery Research in the Eastern Mediterranean (OLIVER *et al.,* 1997). On the other hand, the FAO fisheries' statistics database has now been updated until 1994 (FAO, 1995). All these allow a fairly complete panoramic synthesis of the situation to be drawn. LLEONART (2002) describing the fisheries' assessment methodology applied in the Mediterranean concluded that most fisheries' research projects have a local contingency. The only exception is the MEDITS programme (BERTRAND *et al.,* 2002), funded by EU and France, Hellas, Italy and Spain and extending along the north coasts of the Mediterranean Sea, including Albania, Croatia and Slovenia since 1994, and Tunisia and Morocco later. Of 36 assessments of the hake in the Mediterranean, 28 concluded that it is over-fished and 7 that it is fully exploited. Of 32 red mullet assessments, 18 found it over-fished. Most of the targeted demersal fish stocks and the large pelagic stocks are considered either fully exploited or even over-fished. For the small pelagic the picture was more diverse, with only 2 of 14 assessments of the anchovy stocks rating it as over-fished and the sardine stocks rated as within safe limits.

Time-series of fishery landings can provide important indications for changes in a fishery, or changes to the underlying environment (CADDY, 1990). Often, as in the case of Mediterranean fisheries, this is essential in the absence of complete or independent information such as on the fishing intensity or fishing mortality affecting the stock. Fishery landings' trends can provide the only indication about important changes that might have occurred in the past. FIORENTINI *et al.,* (1997) based on the 45-year time-series of landings gave a general view of the catches in the Mediterranean:

(a) Despite some significant differences, the overall pictures from the west and the east Mediterranean are not strikingly different.
(b) From the study of catch trends, a high proportion of species or species groups in both the west and east Mediterranean showed increases in landings over the whole time period until the late 1990s.
(c) From the perspective of stock assessment, very few time-series showed stable yield levels, suggesting a considerable dynamism caused by environmental and/or trophic or fishery-related impacts in the fisheries of the sub-region.

Catch statistics on demersal and small pelagic species show a negative trend in the 1990s for the most important species or groups of species (FIORENTINI *et al.,* 1997). Daily catch rates per vessel have fallen dramatically when compared to catch rates of some decades ago, despite the fact that the power and efficiency of fishing vessels has increased in recent times. Also the catch quality, both in terms of species and size composition, has been changing over time. Long life-span species and bigger sized specimens have practically dis-

appeared from demersal catches in several areas and fisheries. The current evaluation of demersal, small and large pelagic fisheries, carried out within the GFCM and ICCAT frameworks, confirm this picture of over exploitation of several resources and highlights the need to reduce the mortality of juveniles and the overall current fishing effort by about 15-30% for those fisheries catching some over exploited stocks[4]. Despite the recognized over exploitation of several resources, there are few scientifically reported cases of stocks at risk of collapse.

Deep fish resources

The exploitation of deep waters for fisheries is probably a new perspective for the development of fisheries in the Mediterranean Sea. Deep fisheries in the area are developed mainly in the western Mediterranean and in some areas of the central region (Italian coast of the Ionian Sea) at depths extending down to 800-1 000 m, while recently this fishery is under development in the Aegean Sea. The most important stocks are those of the two species of red shrimps: *Aristaeomorpha foliacea* and *Aristeus antennatus*, and of lesser importance the hake and the red fishes. Fishing activity is carried out mainly by trawlers and secondly by netters or long liners adapted accordingly for fishing in deep waters. The condition of the red shrimps stocks along the coasts of Spain and Hellas is considered satisfactory regarding over-fishing, while along the Italian coasts the stocks are over-fished. The extension of bottom trawl fishing activities in deep waters would take the pressure off the shallow water species and would provide the fish market with new products. However, this could involve the danger of disturbing the deep-water ecosystem which is more fragile, and where the recovery of the depleted stocks will require more time and complicated management interventions as related with other shallow water stocks. Therefore, knowledge on the biology and on the interspecific relationships of the deep-waters species is needed in order to plan a reasonable managing design.

THE CONSERVATION POLICY OF MEDITERRANEAN FISHERIES' RESOURCES

Fisheries' management in the Mediterranean is, in general, at a relatively early stage of development, judging by the criteria of North Atlantic fisheries. Quota systems are generally not applied, mesh-size regulations usually are set at low levels relative to scientific advice, and effort limitation is not usually applied or, if it is, is not always based on a formal resource assessment (ANONYMOUS, 2001).

The importance of Mediterranean fisheries was fully recognised by the adoption, in October 2002, of an ambitious Action Plan[4] to ensure the sustainability of fisheries in the Mediterranean. The measures foreseen in the Action Plan include: a concerted approach to declaring fisheries' protection zones, the use of fishing effort as the main instrument in fisheries' management, improving fishing techniques so as to reduce the adverse impact on stocks and the marine ecosystem and promoting international co-operation.

Moreover, in the Mediterranean there are two regional fisheries' organizations, ICCAT and GFCM, which have different degrees of development and activity. ICCAT plays and should maintain an essential role in the management of highly migratory species in the region. EU is committed to this organization at both management and scientific levels, and it has been in the forefront in pressing the on-going work within that organization for the establishment of a control and enforcement scheme. GFCM, which is the most appropriate forum for the management of demersal and small pelagic fisheries in the Mediterranean, has made considerable strides in recent years, essentially due to initiatives which have been taken by the EU and Member States.

On a national level, the fisheries' legislation of the different Mediterranean countries contains a great variety of conservation/management measures which can be broadly separated into two major categories: those aiming to keep the fishing effort under control and those aiming to make the exploitation patterns more rational. The first set of measures is based on restrictions imposed on the number or fishing capacity of the vessels, rather than on catch limits and control of discards and by-catches, upon which the fisheries' policy in the Atlantic mostly relies. The second set of measures is based on provisions concerning gear specification, gear deployment, fishing practices or techniques, fishing seasons or areas and resource exploitation patterns, and are commonly known as technical measures.

Mesh sizes is an important item to manage fishery and especially the trawl fishery. The smallest sizes for trawls in the world are found in the Mediterranean (CADDY, 1990). The goal of a 40 mm mesh size proposed by the GFCM and adopted recently by EU member states[5] is still far from realistic in many Mediterranean countries. The relatively high

4 COM/(2002), 535 final. 09.10.2002

5 EU Council Regulation No 1967/2006

price of small fish, the existence of some small species that would not be caught, and the short-term losses that would occur as a result of increasing mesh size, are the main reasons which would make this measure difficult to apply. Furthermore, the control and surveillance of actual mesh sizes entails the difficulties involved in the individual examination of vessels at sea. Another type of regulation which is adopted in the recent EU regulation is the use of square nets in order to improve selectivity of trawls.

Apart from the main target of a management policy, which is the conservation of fisheries' resources, the establishment of a common fisheries' policy in the Mediterranean should also take into account the political and socio-economic aspects of the Mediterranean nations that share in the exploitation of these resources. A number of technical measures have already been woven into the national laws of all FAO/GFCM Member States (TSIMENIDES, 1994).

Following extensive discussions in the early 1990s on the general principles of a conservation and management policy specifically for the Mediterranean, the Council adopted Regulation (EC) No. 1626/94 laying down certain technical measures for the conservation of fishery resources in the Mediterranean. This particular regulation was never accepted and applied by the member states. Many provisions of this regulation were never applied. Following the approval of the new reformed Common Fishery Policy in December 2002, discussions were initiated to change this regulation. From these discussions it became obvious the need for a serious re-evaluation of the mesh-sizes of some gears, the landing sizes of some commercial species, the legal distance from coast to practice fishing, the least depth of use of the various gears, etc. The new regulation for the management of the Mediterranean fisheries was approved finally following extensive discussions with the participation of fishermen (especially the representatives of trawler and purse seiner fleet segments).

The GFCM has attempted to harmonize, on a Mediterranean level, some of those technical measures. The need for a reduction in overall fishing effort, particularly in inshore waters, remains the main priority for management action. So far, few Mediterranean countries have taken management action to control increases in fishing effort, in spite of repeated recommendations by the GFCM. For the Mediterranean countries, members of the EU, a limitation in total fleet capacity and horsepower are in effect.

SOME PROBLEMS IN THE MANAGEMENT OF THE MEDITERRANEAN RESOURCES

All the Mediterranean fisheries' research institutes have scientific teams capable of studying the biological and dynamic parameters of the most important stocks, as well as the fleets' dynamics and interactions. The existence of good quality and quantity catch and effort statistics remain, however, a weak point. Official statistics are not fully accurate in the Mediterranean countries and so they are not reliable; in several countries suggestions have been made to improve those data, but the majority of the statistical data are still often very far from reflecting the reality. The lack of reliable official statistics is a considerable handicap for researchers who must devote a significant proportion of their resources estimating the corrective factors to apply to official statistics.

As for the inventory of the fleets, it leaves much to be desired in most countries. The statistics do not sufficiently describe the structure and capacity of the fleets, which depends on heterogeneous factors such as the depth of the fishing grounds, the type of fishing activity, the economic level of the fishermen, the shipbuilding, traditions, etc. Particularly, as regards the small-scale fleets, the files available in the national administrations are generally quite incomplete. An underestimation of about 50% compared to the real figures is not rare and of course, it can introduce important biases in the analyses. To avoid this situation, the latest works in the area have focused on improving sampling and assessment strategies, essentially based on the installation of networks of samplers on the coasts, which particularly apply to Mediterranean fisheries.

Another important point is that, despite the apparent very complex situation which the multi-specificity of the Mediterranean catches seems to show, some 'target species' can be identified as main indicators of the status of composite stocks and thus there is a possibility of reducing the assessment tasks to a relative level very similar to what it is in other parts of the world. For example, as noted during the EU Meeting on Mediterranean Fisheries (Ancona, Italy, 1992) it can be defined, for the north-western Mediterranean fisheries, a group of 13 species which constitute the 'basic production'. Even if imperfect, the landing statistics show that this group represents more or less 50% of the overall demersal production of the European fleets (ANONYMOUS, 1992).

Additionally, another problem of fisheries' manage-

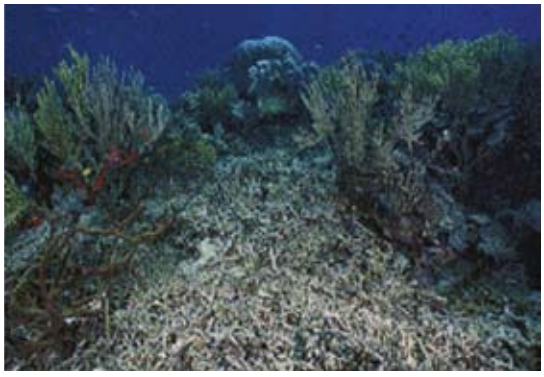

Figure 4: Illegal fishing techniques like blast fishing and the use of home-made illegal gears is still a problem for Mediterranean coastal and artisanal fisheries due to limited man-power of law enforcement agencies.

ment in the Mediterranean is the lack of effective surveillance/enforcement by authorities, which is due to the extended coastline and the numerous landing sites making it difficult to detect illegal fishing (Figure 4). In fact the GFCM has put forward a scheme aiming to ensure a high degree of compliance with relevant conservation measures, and legal certainty and security for the vessel concerned, indicating a number of principles that an effective Control and Enforcement Scheme should embody (GFCM, 2007).

REQUIRED ACTIONS AT INTERNATIONAL LEVEL

Improvement of scientific advice through research activities

As regards scientific research in general, most of the findings of the research projects in recent years have proved to be useful to support scientific work within the scientific bodies of the Regional Fisheries Organizations and of the FAO sub-regional projects e.g. ADRIAMED, COPEMED, MED-SUD-MED, EAST-MED. However, initiatives still need to be taken by the EU to support the scientific work carried out within the Mediterranean regional fisheries' organizations and to strengthen their role to stimulate scientific and technical activities among their parties.

Harmonization of measures in the Mediterranean Basin

Although the EU have taken the initiative on fisheries' management regardless of whether other countries of the region will follow, it is obvious that there is an interest in ensuring harmonization of the management measures applied in the region. The Net should pursue the discussion and adoption of Mediterranean-wide management .measures, particularly within GFCM, to ensure as much consistency as possible between the EU initiative and the management carried out by other countries of the Mediterranean basin.

Co-operation among States and among industries

The Mediterranean Sea is characterized by a high number of coastal states with little tradition and means to ensure fisheries' management. A multilateral fisheries' policy in the region should have an active co-operation policy as a fundamental element. This co-operation should be focused, most notably, on enhancing the coastal States' capability to carry out their international obligations. Data collection, basic research and monitoring and control of fishing activities are some of the possible actions to be favoured in this context. Therefore, the development of a Mediterranean-wide co-operation programme, using scientific experience and the existing financial frameworks as much as possible must be promoted.

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III.3. FISHERIES STATISTICS IN HELLAS: DATA COLLECTION AND PROCESSING

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INTRODUCTION

At present, two entities are routinely engaged in collecting and processing data concerning the primary phase of the fishing industry in Hellas: The National Statistical Service of Greece (NSSG) and the Fisheries Development Company (ETANAL). A third entity, the Ministry of Agriculture (MA), cooperates with NSSG and conducts periodical surveys and/or investigations on specific subjects to cover the existing statistical needs in the fields of management and long-term planning of the fisheries' policy. Moreover, the Ministry of Mercantile Marine (MMM) has established a register of fishing vessels since 1988 which is continuously updated. The type of information collected on the various segments of the Hellenic fishing industry is presented below.

- FISHING FLEET
  NSSG: a) Motorized fishing vessels ≥20HP: registered - yearly, b) motorized fishing vessels ≤19HP and professional rowing boats: operational - yearly.
  MMM: Register of fishing vessels - fisheries census 1988, updated every 3 months.
- PRODUCTION
  NSSG: a) Motorized fishing vessels ≥20HP: monthly - basic statistics, b) motorized fishing vessels ≤19HP and professional rowing boats: yearly - indications.
  ETANAL: Partial coverage: monthly - fish and fisheries' products landed / traded at eleven official fishing ports.
- EMPLOYMENT
  NSSG: a) Motorized fishing vessels ≥20HP: monthly - total, full time, part time, b) motorized fishing vessels ≤19HP and professional rowing boats: yearly - total.
- FISH PROCESSING
  NSSG: a) Inventory information based on census survey conducted every four years, b) yearly production of processed fish and fisheries' production (type - quality).
- INTERNAL TRADE
  NSSG: Inventory information based on census survey conducted every four years (number of employees - wholesale, retail outlets).
- EXTERNAL TRADE
  NSSG: Yearly statistics of imports / exports (collected through taxation offices and customs offices).
- CONSUMPTION
  NSSG: Data collected through household expenditure sample surveys (conducted every five years).
- PRICES
  NSSG: Wholesale and retail prices within the context for the construction of monthly wholesale and retail price indices.
  ETANAL: Monthly average prices by species for the quantities of fish traded at the eleven official fishing ports.
- AQUACULTURE
  NSSG: Monthly census survey of inventory and production characteristics of aquaculture and fish - farming units.

In the paper, the survey systems, methods of data collection and processing procedures of the two entities are described. Also the quality profiles of the produced statistics are presented.

A. THE NATIONAL STATISTICAL SERVICE OF GREECE (NSSG)

This is the official state authority for the collection and compilation of statistical data from various fields of the national economy, including fisheries. In order to obtain fisheries' data, the NSSG uses a nationwide data collection system and cooperates with the Ministry of Mercantile Marine, Ministry of Agriculture, the port authorities, the local customs offices and correspondents in municipalities and communities. The primary objective is to provide catch and employment statistics, but fishing fleet statistics are used to estimate production. The NSSG classification criteria of vessels takes into account the fishing area and the gear used. The fishing area is perceived as the area in which the fishing vessel operates and the where greatest quantity of fish is caught. In total, 16 fishing areas have been delineated in the Hellenic territory and 2 fishing areas outside territorial waters of Hellas (Figure 1). Regarding fishing gear, they are divided into four basic categories: trawl-nets, ring-nets (purse-seines), seine-nets (beach-seines) and others (set-nets, bottom and drift long lines, dredges, small ring nets, sponge-fishing gear, etc.).

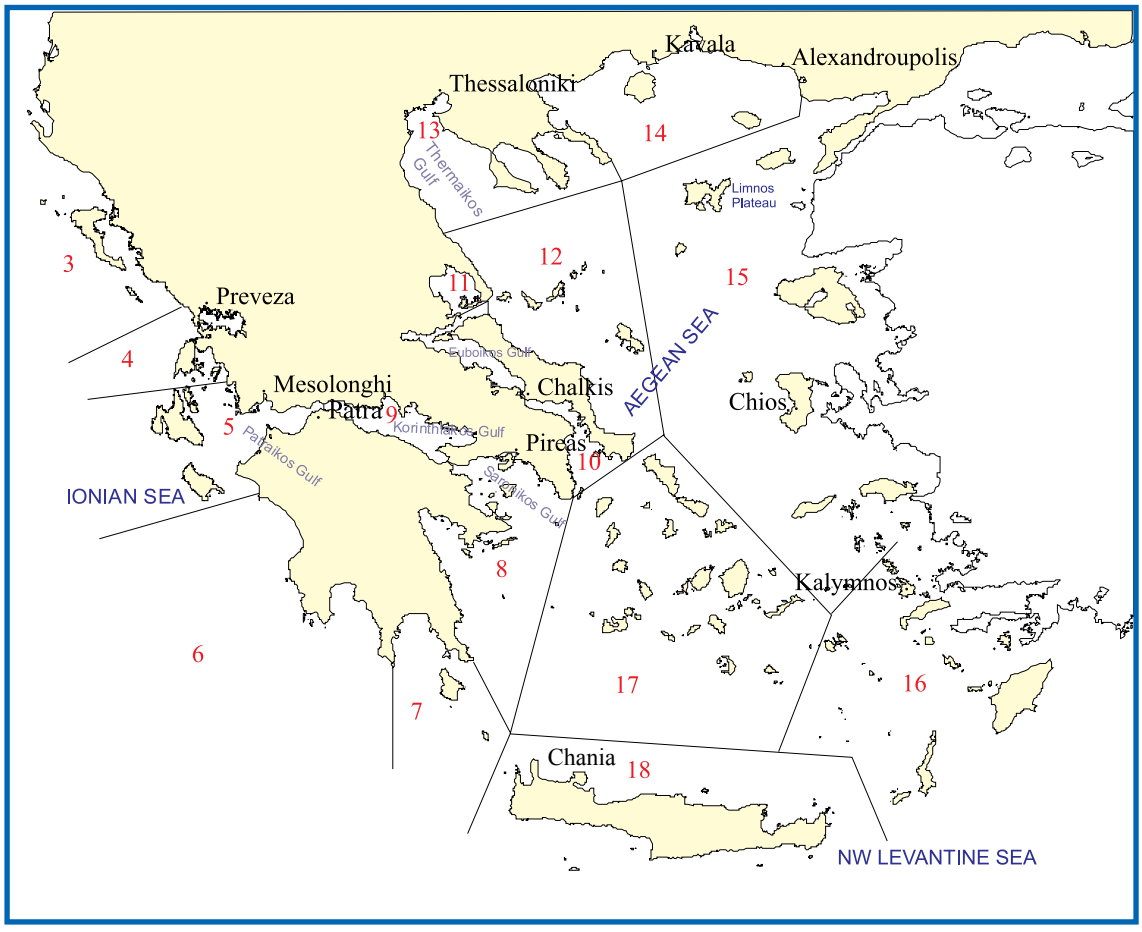

Figure 1: The NSSG fishing areas ([3] Coasts of Ipeiros and Kerkyra, [4] Amvrakikos Gulf and coasts of Lefkada island, [5] Coasts of Kefallonia, Zakynthos and Gulf of Patras, [6] Gulf of Kyparissia and Gulf of Messinia, [7] Gulf of Lakonia, [8] Gulf of Argolida and Saronikos Gulf, [9] Gulf of Korinthia, [10] Gulf of S. and N. Evvoia-Gulf of Lamia, [11] Pagasitikos Gulf, [12] Eastern coasts of Evvoia and Sporades islands, [13] Thermaikos Gulf and Gulf of Chalkidiki, [14] Strymonikos, Gulf of Kavala, Thassos, Thracian Sea, [15] Islands of Lesvos, Chios, Samos and Ikaria, [16] Dodekanisos, [17] Kyklades, [18] Kriti) and the ETANAL fishing port markets

Based on these criteria, fisheries are divided into three categories: a) overseas fisheries, which is operated by trawlers fishing on the coasts of N. Africa and the Atlantic Ocean b) open sea fisheries, which is operated by bottom trawlers and purse-seiners fishing in Hellenic waters, and c) inshore fisheries, which is operated by beach-seiners and vessels of the "others" fishing gear category in coastal waters. With regard to fisheries' production, the products are classified into four major biological groups: fish, cephalopods, crustaceans and pelecypoda. Each group is further divided into species or groups of related species. Furthermore, the products have three quality categories: "first", "second" and "third". In respect of employment, only data concerning the number of persons actively involved in fishing are collected, without a distinction between employers and employees and without reference to sex, age or other social parameters.

Four independent statistical surveys are conducted, each of which is focusing on the particular portion of the fleet:

Sea Fisheries' Survey for Motorized Vessels ≥20 HP (SFS-1): This is a census-type survey conducted on a monthly basis and covers the activities of marine fishing vessels operating in Hellenic waters with an engine power of 20 HP or higher (the survey started in 1964 and up to 1969 it covered the activities of all professional motorized vessels). The following parameters are investi-

gated: fleet characteristics (number, engine power and tonnage of vessels), production (volume and value) and employment.

Fleet statistics are not the immediate concern. Actually, the NSSG does not monitor directly the fleet parameters, but keeps a register of fishing vessels (RFV), mainly for the purpose of deriving raising factors for computing the national production from the catch data of individual vessels. The initial information was based on the results of the fisheries' census, which was conducted in 1962. A new register of fishing vessels has been established and is continuously updated by the Ministry of Mercantile Marine.

For collecting data, the "reporting" measurement approach has been adopted according to which information referring to the quantity of fish caught, the area fished, the personnel employed and the number of working days is provided directly by the fishermen. Practically, the "sampling" survey method was adopted, under the rough assumption that the respondents constitute a random sample of the target population. Using appropriate raising factors derived from the RFVs, the catch and employment data of the respondents were utilized to assess the total fisheries' production by fisheries' sector, gear, geographical area, month of fishing, biological category, quality class and value, and also provide employment data by the fisheries' sector. The fishermen are asked to complete a monthly statistical questionnaire, or to indicate that their vessel did not work. The questionnaire provides information on the characteristics of the vessel, the labour force, the fishing area, the number of working days or states the reasons for inactivity, the fish landed and the average sale price by category of fish. Code numbers are allocated to the individual species and groups of species within the established biological categories. The completed questionnaires are forwarded to the local offices. Each customs office represents a number of fishing ports and landing places, where the active fishing vessels are located. The collected questionnaires are submitted directly to the NSSG for editing and further processing. The results of the survey are published in the annual bulletin under the title "Sea fishery by motor vessels". The time lag between data collection and publication of the results is 2-3 years. Output tables are given below:

Part one, Yearly summary comparative tables

I. Number, horsepower and tonnage of motor-propelled fishing vessels, by categories.
II. Quantity and value of catch, by categories and kind of fishery.
III. Quantity and value of catch, by categories and kind of fishing tools.
IV. Quantity of fish landed, by principal species.
V. Quantity of fish landed, by fishing areas.
VI. Annual average employment, quantity landed and value of catch, by kind of fishing tools.

Part two, Analytical tables

A.1: Distribution of motor fishing vessels, by categories and horsepower groups.
A.2: Distribution of overseas and open sea fishing vessels, by tonnage groups.
B.1: Quantity and value of catch, by categories and kind of fishery.
B.2: Quantity and value of catch, by categories and kind of fishing tools.
B.3: Quantity of catch, by principal species and kind of fishing tools.
B.4: Quantity of catch, by principal species.
B.5: Quantity of catch, by fishing areas and kind of fishing tools.
B.6: Quantity of catch, by principal species and fishing areas.
C.1: Number of persons employed, by kind of fishing tools.
D.1: Quantity, value and average price of catch distributed by fish-pier, by main species (from 1999 and afterwards).

Quality profile of SFS-I

From the methodological and operational aspects of statistics produced by the NSSG, conclusions can be drawn on the quality of the information provided and the various sources of bias introduced during the sampling design and planning, data collection, processing and tabulation processes.

As regards sampling and planning operations, the following problems are identified: a) Due to the huge scale of the field and processing operations, the census method with a monthly frequency, is subject to serious systematic errors and provides no measure for the margin of error to which the data are subject, b) no provision was made during the design process to produce the appropriate mapping material showing the statistical units under the coverage of each customs office. The consequence may be omissions and duplications, c) the accuracy of the RFV is low and becomes a source of bias in the estimation of the raising factors for inferring population values from sample catch data, d) the criteria for the classification of the catch in quality categories are not defined, and in practice the fishermen use their own classification criteria.

With regard to the measurement procedure, the main problem is the response bias associated with

the method in data collection. The reporting approach for data collection is highly subjective, since it is not based on actual measurements of landings or logbooks, but on information provided by the fishermen. The acceptance procedures are not defined and there is no procedure to clear up difficulties, check answers and ensure completeness. This situation introduces several response errors during the data collection process, such as: a) provision of distorted answers by the fishermen, b) possible cheating concerning the economic data, c) introduction of a memory error resulting from the length of the reference period.

Further to the biased nature of the obtained sample data, the procedures employed in data collection introduce several measurement errors arising from: a) lack of training and briefing of the staff of the customs offices, b) lack of written instructions, c) lack of field observation, d) lack of standardization of the work performed in data collection.

At the processing stage, all operations preceding computer processing are essentially reading through the questionnaires with no quality control or checking error techniques at the processing stage.

Regarding the final output of the survey, the established tabulation system is incomplete, in the sense that it utilizes only a portion of the spectrum of information obtained in the survey. One of the major drawbacks is that the results of the production statistics are presented only by fishing area, which make a sense from the management point of view, but does not satisfy the needs of many potential statistic users. Classification of the fleet and catch data on a prefecture basis, which is the official administrative unit, is certainly required. In addition, there is a real need to broaden the scope of the tabulation programme by including additional characteristics concerning: a) operational statistics on fishing effort (number of fishing days and reasons for inactivity), b) Quantity of catch, by principal species, kind of fishing tools and fishing areas, c) Number, horsepower and tonnage of motor-propelled fishing vessels, by categories and by prefecture/fishing areas.

Sea Fisheries Survey of Motorized Vessels ≤19 HP (SFS-2): This survey started in 1970 and covers the "inshore" component of the fisheries which is operated by motorized vessels with an engine power of 19 HP or less. The number of operational vessels and the quantities of fisheries' products landed during the previous year are investigated. Production is not directly measured, but is estimated by multiplying the number of vessels by the annual average total catch per fishing vessel. For this purpose old catch data per fishing vessels are utilized. The annual catch per vessel has been assumed stable and is kept fixed over time (~2 tons/vessel/year).

Quality profile of SFS-2

Both the procedures and methodology used for obtaining and processing data suffer from certain drawbacks, which reduce the validity of the results. The main factors which adversely affect the quality of the statistics are: a) poor coverage of important statistical items (seasonality of fishing, species composition of the catch, value indications, part-time employment), b) the inappropriateness of the persons responsible for data collection (secretariats of the municipalities and communities), c) the very subjective method used for estimating the annual catch per vessel, d) poor quality control and error-checking procedures.

Sea Fisheries Survey of rowing boats (SFS-3): This survey which started in 1962 essentially investigates the number of operated rowing boats. Information is collected from the secretariats of the coastal municipalities and communities who are asked once a year to fill in relevant statistical questionnaires referring to the items of interest.

The results of SFS-2 and SFS-3 surveys are published in the annual bulletin "Yearly Agricultural and Livestock Production" along with the results of the statistical surveys on other branches of the Agricultural Economy.

Overseas Fisheries Survey (SFS-4): This is a monthly survey addressed to vessels operating in the Atlantic Ocean and on the coasts of N. Africa. The survey is based on the census method and uses the reporting approach (fishing companies report data on production and employment directly to the NSSG). Essentially the survey covers the same characteristics as the SFS-1 survey. No data are compiled on the number of trips of each fishing vessel and the number of hours spent fishing. The results are tabulated in a manner similar to the results of the SFS-1 survey and appear together in the annual issues of the bulletin "Sea fishery by motor vessels".

Quality profile of SFS-4

Due to the low number of overseas fishing vessels and the efficiency of their respective companies, the response rate to the questionnaire is high, and therefore, the census type survey is appropriate for the statistical investigation of this fisheries'

branch. The actual number of operating fishing vessels calls for a specific investigation.

B. THE FISHERIES DEVELOPMENT COMPANY (ETANAL)

The fisheries' development company ETANAL S.A. has provided the general framework and methodology of the system of measurement of landings in the fishing port markets but is not directly involved in the collection and processing of data. This is the responsibility of the individual fishing port markets, which have their own administration. ETANAL simply acts as a coordinating body.
Data are obtained on a daily basis by recording the quantities and prices of the transacted products. Data collection started in 1969 and initially covered only six fishing port markets. Gradually, with the addition of new fishing port markets, the data collection network was extended, and it now covers 11 fishing ports (Figure 1).

The Transportation, Transaction and Marketing Methods

A census survey was conducted with the assistance of ETANAL with the overall objective to assemble information on the transportation, transaction and marketing methods, the controls exercised and the documents used for data collection in the individual fishing port markets.
For the collection of the required information a precodified Recording Schedule (RS) was designed. The variants which are included in the Recording Schedule provide, on the one hand, detailed information on the methods and practices followed in each fishing port market, and on the other hand, can be used to produce the needed indicators which would best discriminate between fishing port markets.

a. Transportation

The two main transportation methods of Hellenic marine fisheries' products used in the individual fishing port markets are: a) direct landings of marine fishing vessels and b) inland transportation. The relative importance of these two transportation methods, expressed by their percentage contribution to the total inflow of Hellenic marine fisheries' products in the individual fishing port markets, is given in Table 1.

b. Marketing

The census results provided, among other things, two kinds of information on the transportation of products: The Movement Network System of products between fishing port markets, and the Transportation System of products in the fishing port markets from other fishing ports. It should be noted that the states of the Movement Network System and the Transportation System are not constant on a monthly basis and depend on a seasonal pattern.
As a result, out of the total of 11 fishing port markets, the 8 fishing port markets (01, 02, 03, 04, 05, 06, 10, 11), are "mixed fishing port markets" in the sense that they receive products from other fishing port markets and dispatch products to other fishing port markets. The remaining 3 fishing port mar-

Table 1. The relative importance of various transportation methods of marine fisheries' products in individual fishing port markets, expressed by their percentage contribution to the total inflow quantities.

Fishing port markets	Transportation methods		
	1. Fishing vessels	2. Inland transportion	3. Other (sea transportation)
01. PIRAIAS	25%	75%	
02. THESSALONIKI		100%	
03. KAVALA	75%	25%	
04. PATRA	40%	60%	
05. CHALKIS	40%	60%	
06. CHIOS	70%	30%	
07. ALEXANDROUPOLIS	90%	10%	
08. MESSOLONGHI	20%	80%	
09. KALYMNOS	20%	30%	50%
10. PREVEZA		100%	
11. CHANIA	100%		

kets (07, 08, 09) are "dispatching fishing port markets" in the sense that they only dispatch products to other fishing port markets. The mixed fishing port markets with heavy movement of products are Peiraias (01) and Thessaloniki (02), followed by Kavala (03), Patras (04) and Chalkis (05).

c. Transactions

There are significant differences between fishing port markets concerning the forms of transaction. The two extreme cases are the fishing port market of Kavala (03) where four forms of transactions are utilised (fish-producers and fish-traders, fishermen's Associations and fish-traders, fish-brokers and wholesalers, fish-brokers and retailers), and the fishing port market of Preveza (10) where only one form of transaction is employed (fish-producers and retailers).

In all the fishing port markets both the pre-auctioning arrangements and auctioning transactions are conducted independently by the persons concerned. Controls are exercised only in the fishing port markets of Chalkis (05), Messolongi (08) and Preveza (10). In the auction procedures, a variety of administrative controls are exercised within the fishing port markets of Peiraias (01), Thessaloniki (02), Kavala (03), Chalkis (05), Chios (06), Alexandroupolis (07) and Messolongi (08). Controls are not exercised at all in the fishing port markets of Patras (04), Kalymnos (09), and Preveza (10).

There are also significant differences between the fishing port markets concerning the controls exercised at the exit of the transacted fisheries' products from the fishing port.

The Existing Administrative Fisheries Statistics

The system of data collection has been adjusted to the adopted method of auction sales carried out in the fishing port markets. In particular, the quantities and prices of the sold products are recorded when the buyer is called to present an invoice or other relevant document at the exit from the fishing port market in order to be charged with a percentage of the value of the transacted products for port expenses.

Although all fishing port markets follow to some degree the above method, there are marked differences between fishing port markets regarding the controls exercised during the auctioning and data recording procedures. These procedures have not been standardized. It can be said that each port has established its own methodology which suits the means available and the local conditions of marketing. Inevitably, the statistics produced differ between ports regarding coverage, completeness and reliability.

A detailed investigation of the kind of information provided by different fishing port markets revealed that two major groups of fisheries' statistics are available: a) Basic fisheries' statistics which are produced by all fishing port markets and meets the requirements set up by ETANAL and, b) additional statistics which are available in some fishing port markets.

The basic fisheries' statistics consist of three parts, which cover the following: 1) Transacted inflow quantities (number of fish boxes and weight in Kgs) and value (gross total value, average sale price and range of prices) of individual species fished in Hellenic marine waters, along with their code numbers, classified by major biological group (fish, cephalopods, crustaceans and mollusks), individual species from inland water fisheries, individual species from overseas fisheries, imported species which are transacted through the fishing port markets. These species are not given code numbers. 2) Summary of basic survey items and additional information concerning products imported and products transferred from the fishing port market in question to other fishing port markets: a) Total of marine and freshwater products grouped by major biological categories (total quantity and value of fishes, cephalopods, crustaceans and mollusks), b) total quantity and value of imported fisheries' products (fresh, frozen), c) total quantity, value and average price of products classified by quality (A-class, B-class, C-class), d) quantity of products transferred from the given fishing port market to other fishing port markets. 3) Detailed information on the quantity, value, average sale price and range of prices of the 19 commercially most important species classified by freshness and size category (this information is collected since 1989).

Additional administrative fisheries' statistics are available in a number of fishing port markets: 1) For a number of years the biggest fishing port markets (Peiraias, Thessaloniki and Kavala) collect information on a daily, bi-weekly and monthly basis on the three species particularly important to the processing industry (sardine, anchovy and mackerel). The data items collected cover landed quantities, average sale prices and quantities sold for human consumption, quantities sold for processing and quantities withdrawn. 2) The fishing port markets of Thessaloniki, Kavala and Patras collect monthly information on the quantity, value and average sale price of products classified according to their origin, as follows: a) Medium Fisheries prod-

ucts, further subdivided by type of fishing vessel (trawlers, day purse-seiners, night purse-seiners and beach seiners). The number of Medium Fisheries vessels landing in the port in question during the previous month is also given, b) coastal fisheries and aquaculture products (including lagoon farming), c) Inland water fisheries' products, d) imported products, d) the fishing port market of Thessaloniki provides assessments of labour force (number of fishing workers) and productivity, expressed in production per vessel and production per fisherman, for the Medium Fisheries, based on the assumption of a fixed number of crew members employed by the vessels of each fisheries' branch.

Neither the Basic nor the Additional Administrative Fisheries Statistics are published. The results of the Basic Administrative Fisheries Statistics are tabulated by each fishing port market in the form of a monthly statistical leaflet which is common for all fishing port markets and is distributed to relevant authorities and interested bodies. Each statistical leaflet provides information on the transacted products during the previous month. The same tabulation format is used by all fishing ports, but the degree of coverage and completeness may differ between ports.

Yearly statistical leaflets are produced by adding up the monthly data. ETANAL tabulates the information obtained from the annual statistical leaflets of fishing port markets to produce a similarly structured annual statistical leaflet which refers to the yearly total transacted fisheries' products in all fishing port markets of the country.

Monthly and annual leaflets providing additional administrative fisheries' statistics are also prepared by the fishing port markets.

From 1999 and thereafter, a table showing the quantity, value and average price of catch distributed by fish-pier, by main species and by month. has been incorporated in the annual publication of NSSG leaflet titled "Sea fishery by motor vessels"

Improvement of the Operational Aspects of the System

For the improvement of the operational aspects of the system, actions should be taken in the following two fields of interest. The first concerns the improvement of the quality of species' classifications. The second concerns the introduction into the system of a procedure for checking the accuracy (=validity) of the produced statistics on a current basis (=monthly).

The problem of species misclassifications: Due to the fact that Hellenic common names are used, the same common name is used in different locations for different species, and different species may appear under the same name.

A Check Sample Survey (CSS) is proposed to be executed aiming to provide the needed information for assessing the magnitude of the problem, estimations of the size and direction of the measurement bias inherent in the calculated estimates on a species basis, and computer de-biasing methods. The same information will also be used for the revision of the existing list of species.

A "matching scheme" is proposed to be used in the questionnaire design of CSS for obtaining the required multiple items of information for quality checking. Survey data in CSS will be collected from a sample of purchasers/invoices basis (=survey units) at the exit of the sample fishing port markets. The "matching scheme" consists of two parts. These will be completed simultaneously on a sample survey unit basis at the measurement process of CSS: Part-A (AFS): is used for recording the species' Hellenic common names and the respective transacted quantities (number of fish boxes, Kgs) as they appear in the purchase invoice (sample). Part-B (CCS): is used for recording the respective fresh correct information on the survey characteristics concerning the true species' names and quantities.

The statistical matching of the parallel records appearing in parts A and B of the matching scheme will provide the needed sample data for assessing the magnitude of the problem of species' misclassifications, the estimation of the size and direction of the measurement bias inherent in the calculated estimates on a species basis, and the development of the computer methods for their de-biasing. Also, the same sample information will be used for the revision of the existing list of species.

For the sampling design of CSS, the method of "Two-stage sample in space and time" is proposed. In the sampling scheme, the first-stage sampling units (=Primary Sampling Units, PSUs) are the survey fishing port markets, and the Secondary Sampling Units (SSUs) are the survey units (purchaser/invoice).

For the area sample of CSS, the five fishing port markets in which controls are exercised at the exit of their transacted fisheries' products are (01. Peiraias, 02. Thessaloniki, 03. Kavala, 05. Chalkis, 06. Chios) and the important fishing port market of Patras (04) - without exit control - can be selected.

For minimizing the cost of CSS, "sampling in time" will be introduced into the sampling design of the survey. Specifically, by taking into account the

transaction seasonality pattern of Hellenic marine fisheries' products in the survey fishing port markets, time-strata (=seasons) can be introduced into the system and two sample weeks will be randomly selected within each time-stratum. Within the sample weeks, daily data will be collected from pre-determined samples of SSUs by using the method of a simple systematic sample with a random starting point.

The proposed CSS is an efficient sampling design and will yield a high precision of the required multiple survey characteristics at a low cost.

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III.5. HELLENIC MARINE FISHERIES: A GENERAL PERSPECTIVE FROM THE NATIONAL STATISTICAL SERVICE DATA

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INTRODUCTION

The vast majority of Hellenic landings are fished in Hellenic marine waters (FAO 2004) that include part of the Ionian and NW Levantine Seas and the entire Aegean Sea. The Ionian is mainly fished by Italy, Malta, Hellas, Albania, Tunisia and Libya. In the Hellenic Ionian Sea only the deep fish stocks are partly exploited by the Italian fisheries fleet. The mean Hellenic Ionian landings represented less than 10% of the total Ionian landings in the late 1980s (STERGIOU & POLLARD, 1994) and around 5% in 2004 (based on GFCM/FishStat data for 2004). The Levantine Sea is mainly fished by Lebanon, Turkey, Israel, Syria, Cyprus, Egypt and Palestine. The mean Hellenic Levantine landings, which are mainly composed of large pelagic fish, represent less than 1% of the total Levantine landings. In contrast, the Aegean Sea is exploited only by the Hellenic and Turkish fleets. The Turkish fleet exploits the eastern Aegean coastal zone and part of the central Aegean international waters. The Turkish Aegean landings increased from about 20% of the mean total Aegean landings for the period 1982-1987 (STERGIOU & POLLARD, 1994) to 33% for 2004 (based on GFCM/FishStat data for 2004). This is attributed to the modernization of the Turkish fishing fleet over the last two decades. Overall, Hellenic marine fisheries and aquaculture production is inadequate to support local demand and thus a net amount of 115600 t was imported in 2005 (imports: 213000 t, exports: 97400 t; EUROSTAT 2006).

STERGIOU *et al.* (1997) reviews the marine fisheries' landings and effort for 1964-1987, whereas PAPACONSTANTINOU (2002) overviews the Hellenic fisheries and their regulations. In addition, TSIKLIRAS *et al.* (2007) reconstruct the total Hellenic landings, including those of small-scale fisheries which are not recorded by various authorities, based on recent data. The increase in Hellenic marine landings from 1985 to 1994 and the subsequent decline to almost half of the previous values (TSIKLIRAS *et al.*, 2007) might suggest overexploitation of the resources. However, this peak in the mid 1990s coincided chronologically with the fishing fleet registration (according to the EU requirements), suggesting that this increase is probably biased because of extrapolation and conversion issues. The Hellenic marine fisheries' sector underwent rapid socio-economic changes during the last 25 years mainly because of the participation of Hellas in the European Union. As a result, subsidies, management regulations and fisheries research have been enforced and this has certainly affected fishing capacity, resource management and stock assessment. Thus, the updated landings and effort series are important for the evaluation of the state and management of the Hellenic marine fisheries.

In the present work, the major socio-economic and operational aspects of the Hellenic marine fisheries are examined for the period 1964-2003. In particular, the following aspects are analysed and presented: (a) long-term changes in fishing effort, landings and wholesale value of landings; and (b) landing species' composition per main fishery (i.e. fishing gear used).

SOURCES OF MARINE FISHERIES' STATISTICS

Marine fisheries landings (in metric tons, t) of the Hellenic fleet have been recorded and published in yearly bulletins since January 1964 by the National Statistical Service of Hellas (NSSG Bulletins, 1964-2003). Landings' data are collected directly from a sample of fishing vessels that are surveyed by local customs authorities as described in Chapter III.3. NSSG data are the best figures available with respect to length of time, spatial and temporal resolution, consistency, degree of subjectivity, and statistical design of data collection (ANONYMOUS, 1994; STERGIOU *et al.*, 1997; PAPACONSTANTINOU, 2002).

The Hellenic fishing fleet includes: (a) fishing vessels operating in distant waters (of no concern to the present study); (b) trawlers; (c) purse seiners; (d) beach seiners operating along the coasts; and (e) 'other coastal boats' (including trammel and gill netters, drifters, long-liners, traps, etc.) operating along the coasts. There are also a few vessels, termed 'mixed vessels', which are licensed to operate both as trawlers (mainly in the wintertime) and purse seiners (mainly in the summertime).

For the period 1964-1981, separate landings' statistics are available for 23 taxa and since 1982 for 66 taxa of fishes, cephalopods, crustaceans and

bivalves. Overall, the following types of data are available for 1964-2003: (a) total annual landings per taxon and fishery (monthly commercial landings of taxa per fishery and fishing subarea are not available); (b) monthly landings per taxon; (c) total annual and monthly landings and wholesale value of landings per fishery (data pertinent to the annual/monthly wholesale value of landings per tax-

Table 1. Total annual fishing effort (engine horsepower, HP; boat tonnage, GRT; number of boats; number of fishers), marine fisheries landings (in metric tons) and wholesale value of landings (in million €), Hellenic waters 1964-2003. The mean and standard deviation (SD) are also given.

Year	Fishing effort				Landings	Value ($\times 10^6$)
	HP	GRT	No of boats	No of fishers	t	€
1964	118833	21206	6800	14427	53598	1.55
1965	123363	21369	7124	14478	53460	1.82
1966	131559	21373	7283	14376	52756	1.98
1967	143562	22106	7345	14554	53495	2.04
1968	168977	21523	8399	15201	55944	2.27
1969	179247	20153	8149	14550	60769	2.48
1970	161473	20412	2343	7612	45656	1.83
1971	173730	20242	2431	7366	47178	2.03
1972	173781	22012	2329	7583	54421	2.34
1973	225721	26715	2728	7840	61998	3.16
1974	250189	29690	2823	7053	56819	3.68
1975	285359	31006	3050	7345	62666	4.56
1976	307727	33597	3196	8159	71842	6.44
1977	333613	32021	3544	8402	70220	7.45
1978	371547	33708	3880	8812	74517	9.82
1979	397661	34869	4133	8840	75744	11.62
1980	430656	36727	4426	9385	73140	18.38
1981	467334	38620	4839	10191	75916	23.17
1982	502138	39211	5184	11089	84268	29.67
1983	539556	41381	5586	11213	80925	35.86
1984	567917	43517	5976	11579	88082	44.37
1985	580980	41676	6163	12304	93969	59.55
1986	618131	43728	6480	13285	101397	92.15
1987	653471	45433	6815	14367	106717	96.80
1988	790533	41125	8981	15238	104012	117.68
1989	805196	40248	9089	18960	112549	147.87
1990	823411	41969	9234	19173	112192	174.89
1991	830239	42837	9308	21425	123783	204.26
1992	823388	41969	9232	20035	141352	223.17
1993	819864	41989	9172	19293	155211	247.33
1994	805037	41659	9002	19798	181675	296.70
1995	805446	41552	9026	19162	150187	277.98
1996	815435	41490	9166	18847	148759	278.41
1997	711543	39181	6976	19109	147735	288.21
1998	715901	36146	8128	16952	106988	225.41
1999	678573	35132	7699	16310	109556	246.01
2000	661282	34398	7595	16184	88116	221.04
2001	666033	33779	7676	15738	83259	219.30
2002	636977	33742	7353	15563	85460	233.46
2003	609904	34703	6996	14547	85155	257.92
Mean	**498169**	**31366**	**6392**	**13659**	**89787**	**103.12**
SD	**254314**	**7702**	**2327**	**4361**	**34376**	**110.44**

on is not available); (d) total annual fishing effort per fishery; (e) total annual and monthly number of fishers per fishery (data concerning number of fishers per fishing subarea is not available). It must be pointed out that fishing effort is expressed in engine horsepower (HP), number of boats and boat tonnage (measured in gross registered tons, GRT). Data concerning boat tonnage is not available for beach seiners and 'other coastal boats'. In addition, data concerning monthly fishing effort or annual/monthly fishing effort per fishing subarea is not available.

TOTAL FISHING EFFORT AND VALUE OF LANDINGS

The total annual landings, fishing effort (in terms of number of boats, HP, GRT and number of fishers) and the wholesale value (in euros, €) of the total landings for 1964-2003 are shown in Table 1. Total landings increased from 53 598 t, in 1964, to 85 155 t, in 2003, reaching a peak in 1994 (181 675 t). The total fishing effort increased from 6 800 boats, 118 833 HP and 21 206 GRT, in 1964, to 6 996 boats, 609 904 HP and 34 703 GRT, in 2003 (Table 1). The wholesale value of the landings also increased from 1.55 million €, in 1964, to 257.9 million €, in 2003 (Table 1).

The above-mentioned figures do not include those concerning small coastal boats (i.e. engine <19 HP) and boats operating in distant waters. The total number of the small coastal boats is estimated at 14 000 each catching 300-350 kg/month (NSSG 1998; TSIKLIRAS *et al.*, 2007). Thus, the total annual landings of the small coastal boats range from 50 400 to 58 800 t (average: 55 000 t per year). These figures refer only to the period following 1995. For the period 1970-1994 the average estimated catches of the small coastal boats were 25 000 t per year. The capacity of the distant water fleet in 2003 was 22 boats, 16 829 HP and 3 910 GRT, the total landings 4,566 t and the total wholesale value of the landings 17 million € (NSSG, 2006). Hence, considering that during the last 20 years both the number of fish farms and their production were increased (from 4 farms producing 200 t in 1988, to about 270 farms producing 97 000 in 2004 and 106 000 t in 2005) (AGRICULTURE BANK OF GREECE, 1998; EUROSTAT, 2006), the total Hellenic marine captured and aquaculture production probably ranges between 230 000 and 250 000 t. The latter is true based on the marine captured production (landings) provided by NSSG.

FISHING EFFORT PER FISHERY

The annual number of boats, HP, GRT (except for 'other coastal boats') and number of fishers per fishery for 1964-2003 are shown in Figures

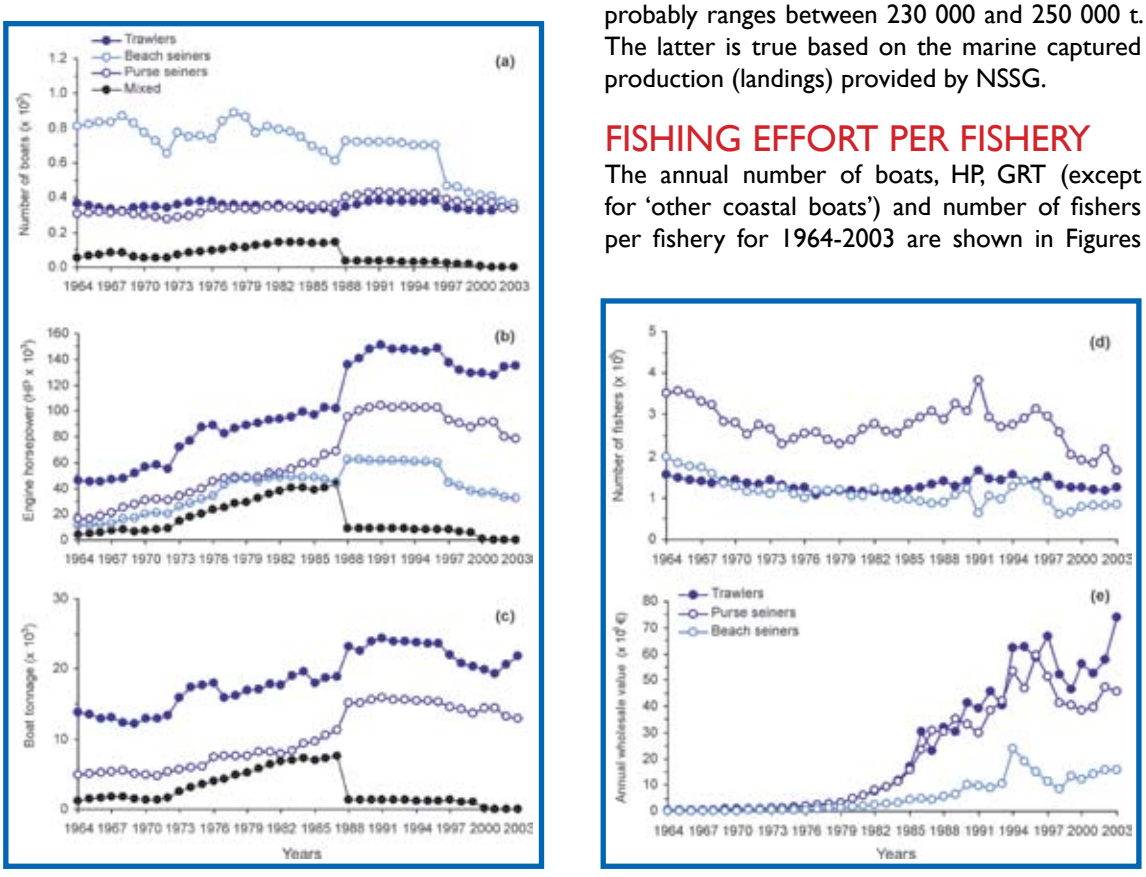

Figure 1: Annual number of boats (a), engine horsepower (in HP) (b), boat tonnage (in GRT) (c), fishers per boat (d) and wholesale value (in €) of landings (e), for trawlers, purse-seiners, beach seiners and 'mixed vessels' operating in Hellenic Seas, 1964-2003.

1 and 2. Although the number of trawlers and purse-seiners did not change considerably between 1964 and 2003 (Figure 1a), this was not true for beach-seiners and 'other coastal boats' (Figures 1a and 2a). Beach-seiners consistently declined since 1964, whereas 'other coastal boats' showed two patterns of change; an exponential increase between 1970 and 1988 and a smooth decline thereafter (Figure 2a). The number of 'mixed vessels' decreased after 1987 (Figure 1b).

The HP and GRT both increased till the late 1980s and thereafter remained more or less constant, fluctuating around a mean of 135 217 HP and 21 778 GRT for trawlers, and 78 229 HP and 12 925 GRT for purse-seiners (Figures 1b and 1c). The capacity of beach-seiners steadily increased over the 1964-2003 period (Figures 1b and 1c), despite the efforts of the Hellenic State since 1979 and those of EU since 1994 to reduce them by advancing measures supporting their withdrawal and/or fully prohibiting renewal/modernisation licences. In contrast, 'other coastal boats' after a sharp decline in 1970, showed an increase till 1988, and then remained in a plateau until 1995 and declined thereafter (Figure 2b). The capacity of 'mixed vessels', i.e. those licensed to operate both as trawlers and purse-seiners, decreased from 1964 to 2003 (Figures 1b and 1c).

The number of fishers remained rather stable for trawlers, purse-seiners and beach-seiners (Figure 1d), whereas for "other coastal boats" increased exponentially between 1970 and 1991 and declined thereafter (Figure 2c). The sharp decline in the number of boats and fishers involved in the 'other coastal boats' fishery in 1970 is attributed to the fact that since 1969 the coastal boats with engine <19HP are no longer recorded by the local customs authorities.

Wholesale value increased exponentially for trawlers up to around 75 million € (in 2003) during the study period (Figure 1e). The mean wholesale value also increased exponentially for purse-seiners and beach-seiners up to the mid 1990s (up to 60 million € for purse-seiners and more than

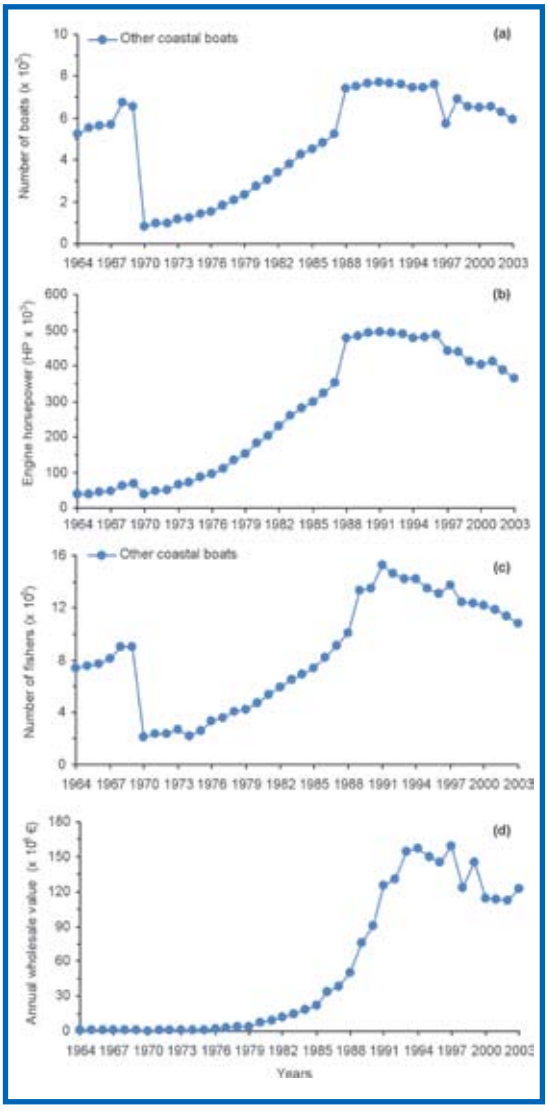

Figure 2: Annual number of boats (a), engine horsepower (in HP) (b), boat tonnage (in GRT) (c), fishers per boat (d) and wholesale value (in €) of landings (e), for other coastal boats operating in Hellenic Seas, 1964-2003.

Table 2. Percentage (%) contribution of the major fisheries to the total fishing effort (expressed as engine horsepower, HP; number of boats; number of fishers) and wholesale value of landings, Hellenic waters 1964-2003.

	Fishing effort			Value
Fishery	HP	No of boats	No of fishers	
Trawlers	21.0	5.6	9.7	23.0
Purse seiners	13.0	5.6	20.1	19.4
Mixed vessels	3.3	1.1	-	-
Beach seiners	8.3	11.1	8.2	5.6
'other coastal boats'	54.4	76.6	62.0	52.0

20 million € for beach-seiners) whereas thereafter declined to lower levels (Figure 1e). As far as the 'other coastal boats' are concerned, the wholesale value of their landings increased exponentially to about 160 million € in the mid 1990s and declined thereafter (Figure 2d).

The socio-economic importance of the 'other coastal boats' is higher when compared with those of the remaining fisheries (Table 2). Thus, the 'other coastal boats' contributed 54.4%, 76.6%, 62.0% and 52.0% to the mean total HP, number of boats, number of fishers and wholesale value of landings over the 1964-2003 period, respectively (Table 2). The HP/boat ratio for trawlers, purse-seiners and beach-seiners showed a linear increase between 1964 and 1988, whereas thereafter remained relatively constant fluctuating around a mean value (Figure 3a). In contrast, HP/boat for 'other coastal boats' remained constant since 1970 (Figure 3a). With respect to GRT/boat, this remained constant for trawlers and purse-seiners from 1964 to 1988, then shifted to a higher value and remained constant thereafter (Figure 3b). The fishers/boat ratio showed a stable pattern for trawlers, beach-seiners and 'other coastal boats' over the entire period, whereas for purse-seiners it decreased (Figure 3c). Finally, the HP/fisher ratio increased for each fishery till the mid 1980s, whereas thereafter fluctuated around 95-120 HP/fisher for trawlers, 30-50 HP/fisher for purse-seiners, 40-95 HP/fisher for beach-seiners, and 30-50 HP/fisher for 'other coastal boats'.

The mean fishers/boat, HP/boat, and HP/fisher ratios all differed significantly (ANOVA, $P<0.005$) among fisheries (Table 3). The mean fishers/boat was higher for the purse-seiners while the HP/boat and HP/fisher ratios were higher for trawlers (Table 3).

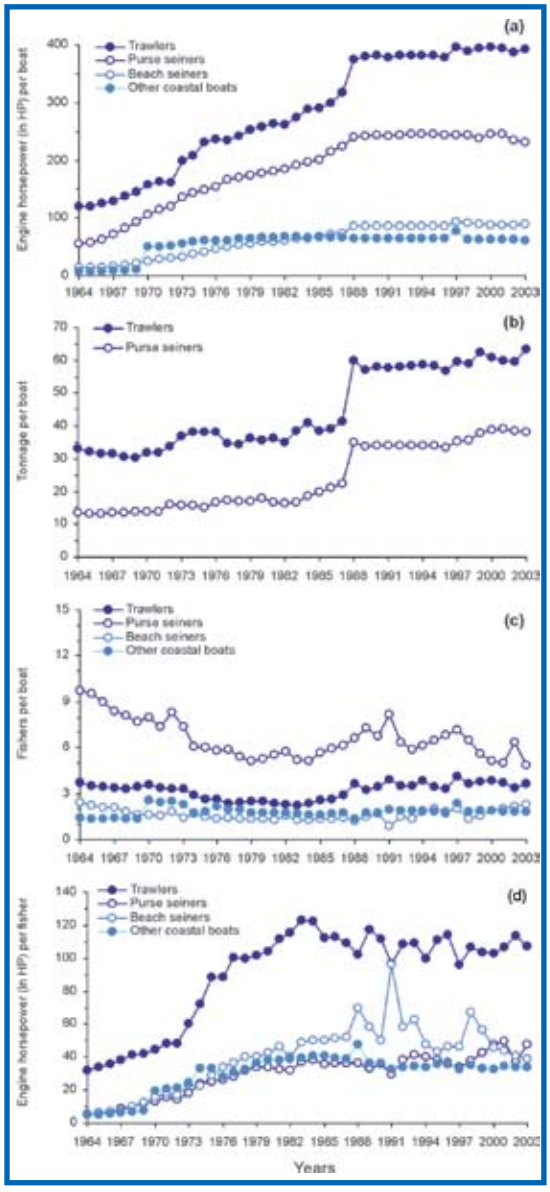

Figure 3: (a) HP per boat, (b) GRT per boat, (c) fisher per boat and (d) HP per fisher, for each fishery operating in Hellenic Seas, 1964-2003.

Table 3. Mean Fishers/boat, HP/boat, HP/fisher, Landings/Boat, Landings/HP, Landings/Fisher, Value/Kg, and Value/fisher ratios for each fishery (trawlers, purse-seiners, beach-seiners and 'other coastal boats'), Hellenic waters 1964-2003. Values with the same exponent (a, b, c and d) do not differ significantly between each fishery.

Ratios	Mean ± Standard Error			
	Trawlers	Purse-seiners	Beach-seiners	Other-coastal
Fishers/boat	$3.19^{a} \pm 0.54$	$6.56^{b} \pm 1.30$	$1.63^{c} \pm 0.35$	$1.82^{d} \pm 0.31$
HP/boat	$282.20^{a} \pm 98.78$	$182.81^{b} \pm 63.71$	$60.62^{c} \pm 27.37$	$54.91^{c} \pm 20.32$
HP/fisher	$90.04^{a} \pm 29.50$	$29.75^{b} \pm 12.36$	$39.56^{c} \pm 20.05$	$29.91^{b} \pm 11.48$
Value/fisher	$17.76\times10^{3a} \pm 18.40$	$7.82\times10^{3b} \pm 8.30$	$6.17\times10^{3b} \pm 6.80$	$4.47\times10^{3b} \pm 4.50$
Value/kg	$1.10\times10^{3a} \pm 1.10$	$0.53\times10^{3b} \pm 0.53$	$0.82\times10^{3c} \pm 0.86$	$1.24\times10^{3a} \pm 1.23$
Landings/Boat	$43.98^{a} \pm 14.78$	$81.35^{b} \pm 15.74$	$10.29^{c} \pm 3.18$	$6.31^{c} \pm 2.34$
Landings /HP	$0.16^{a} \pm 0.03$	$0.50^{b} \pm 0.20$	$0.21^{c} \pm 0.13$	$0.14^{a} \pm 0.07$
Landings /Fisher	$13.77^{a} \pm 3.48$	$12.87^{a} \pm 3.39$	$6.48^{b} \pm 1.83$	$3.42^{c} \pm 1.06$

ANNUAL LANDINGS AND VALUES

The annual landings of 'other coastal boats' increased exponentially from 1964 to 1994, followed by a decline (Figure 4a). A general linear increase was also apparent for the remaining fisheries up to 1994, followed by a decline thereafter (Figure 4a). Landings per HP (i.e. catch per unit of fishing effort) declined for all fisheries but the rate of decline was higher for the purse-seiners (Figure 4b). In addition, the wholesale value per fisher ratio (i.e. annual income) and the wholesale value per landings both increased exponentially during the total period for all fisheries (Figure 5).

The mean value/fisher and the mean value/kg ratios both differed significantly (ANOVA, $P<0.05$) among fisheries. The mean value/fisher was higher for trawlers and the mean value/kg was higher for trawlers and 'other coastal boats' (Table 3). The mean landings/boat, landings/HP and landings/fisher all differed also significantly (ANOVA, $P<0.001$) among fisheries; the mean landings/boat and landings/HP were higher for purse-seiners, whereas the mean landings/fisher were higher for trawlers and purse-seiners (Table 3).

OVERALL SPECIES COMPOSITION OF LANDINGS

Overall, the two pelagic species European anchovy (*Engraulis encrasicolus*) and European sardine (*Sardina pilchardus*) dominated the fisheries landings, comprising 14.6% and 14.1% of the mean total, respectively, over the 1982-2003 period (Figure 6). In addition, seven other taxa (bogue, *Boops boops*; Mediterranean horse mackerel, *Trachurus mediterraneus*; picarel, *Spicara smaris*; Atlantic mackerel, *Scomber japonicus*; European hake, *Merluccius merluccius*; grey mullets, Mugilidae; red mullet, *Mullus barbatus*) each contributed from 2.1% to 7% (Figure 6).

SPECIES' COMPOSITION OF LANDINGS PER FISHERY

The composition of the mean landings per fishery over the 1982-2003 period is shown in Figure 7. In particular, more than 30% of the mean trawl landings was dominated by five species (*M. merluccius*, *M. barbatus*, *T. mediterraneus*, *S. smaris*, and *Micromesistius poutassou*) (Figure 7a). For purse-seiners, five species (*E. encrasicolus* and *S. pilchardus* and, to a lesser extent, *T. mediterraneus*, *B. boops* and *S. japonicus*) cumulatively contributed more than 84% of the mean total landings (Figure 7b). For beach-seiners, more than 60% of the landings was comprised mainly by *S. smaris*, *S. pilchardus* and *B. boops* (Figure 7c). Finally, only 30% of the mean

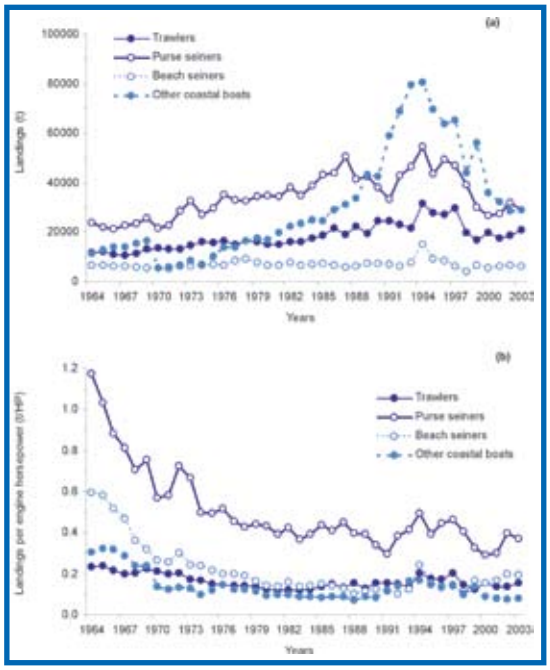

Figure 4: (a) Annual total landings (in t) and (b) landing per unit of fishing effort (expressed as engine horsepower, HP), for each fishery operating in Hellenic Seas, 1964-2003.

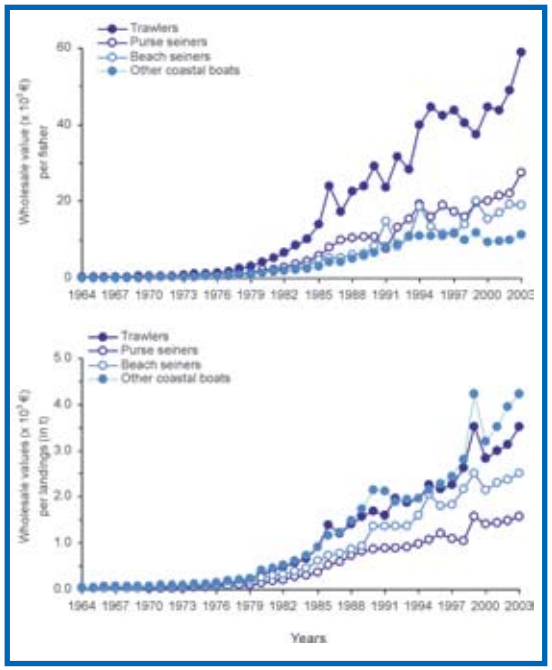

Figure 5: (a) Wholesale value per fisher and (b) value per landings, for each fishery operating in Hellenic Seas, 1964-2003.

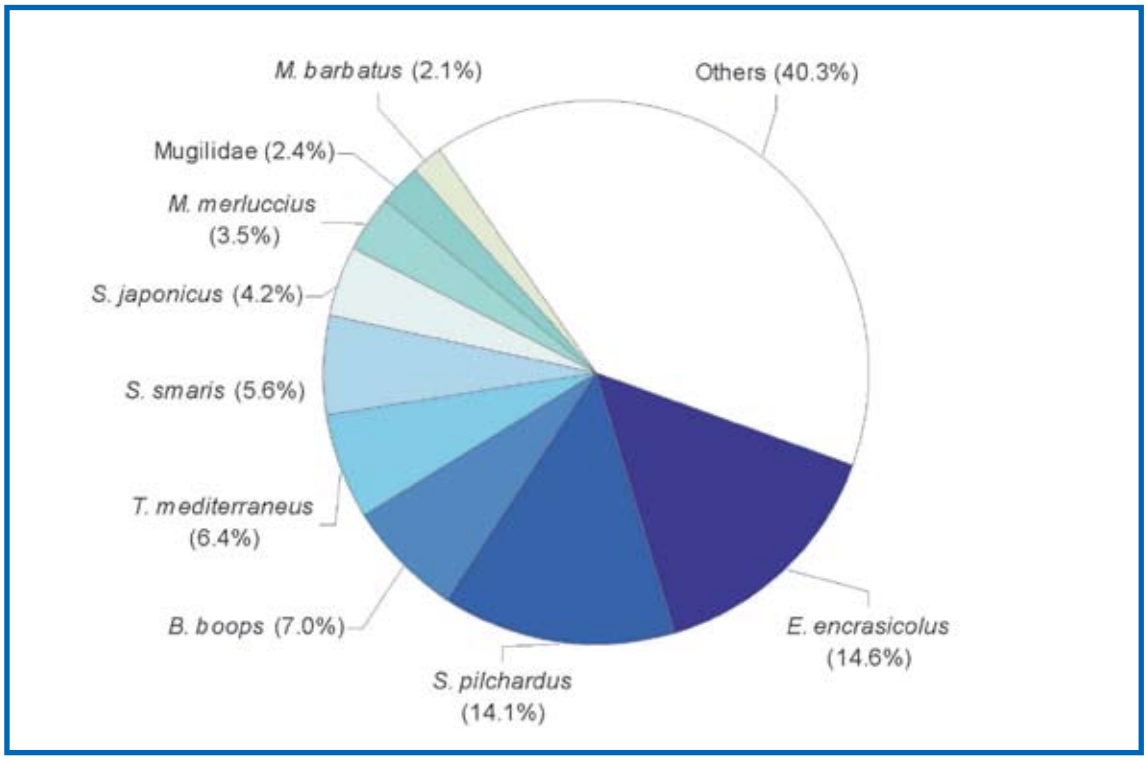

Figure 6: Species' composition of the mean fisheries landings from Hellenic Seas, 1964-2003.

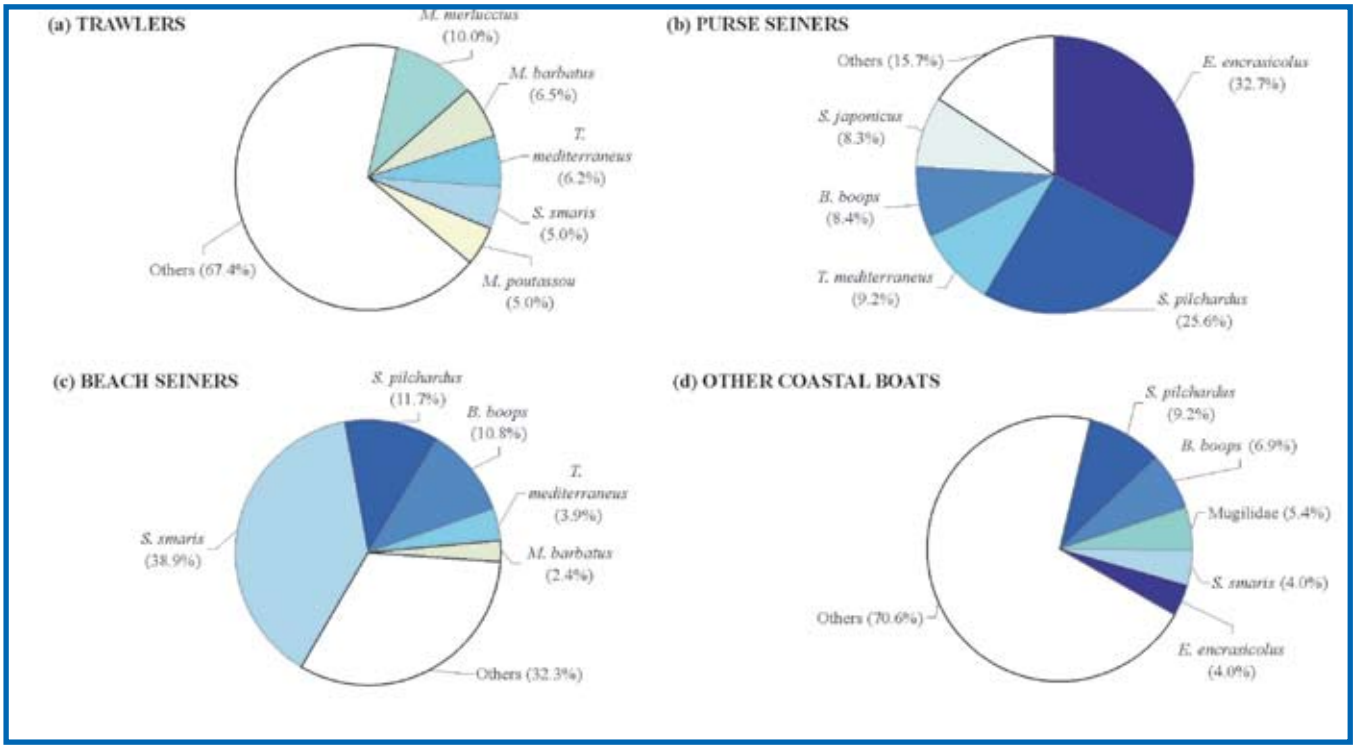

Figure 7: Species' composition of the mean fisheries landings for each fishery operating in Hellenic Seas, 1964-2003: (a) trawlers, (b) purse-seiners, (c) beach-seiners and (d) 'other coastal boats'.

'other coastal boats' landings was comprised of five taxa (*S. pilchardus*, *B. boops*, Mugilidae, *S. smaris* and *E. encrasicolus*) (Figure 7d).

CONCLUSIONS

Our findings showed that the Hellenic marine fisheries are characterized by a large number of species caught per main fishing gear (i.e. multi-species fisheries) as well as by a variety of species that are exploited concurrently by different fishing gears (i.e. multi-gear fisheries). These aspects agree with the findings of various previous studies in Hellenic waters (TSIMENIDES, 1994; STERGIOU & POLLARD, 1994; STERGIOU *et al.*, 1997; KAPANTAGAKIS *et al.*, 2001; PAPACONSTANTINOU, 2002; STERGIOU *et al.*, 2004; STERGIOU *et al.*, this volume). The patterns and propensities of marine fisheries' landings presented in this chapter are based on the NSSG data that are subjected to certain biases and limitations. These can be remedied once the reconstructed dataset (TSIKLIRAS *et al.*, 2007) is adopted.

Hellas, being a member of the European Union since 1981, led to the adoption of new fisheries' management regulations and policies for the Mediterranean (EU Reg. 1626/94, EU Reg. 1967/2006). In addition, Hellenic fisheries have also greatly benefited through the five-year developing programmes, by subsidies which undoubtedly led to the modernization of the fishing fleets and the geographic and vertical expansion of the fisheries. Thus, the increasing trends in effort during 1964-1987 were mainly unregulated, whereas in 1988 the consensus of the Hellenic effort changed and from then onwards it has been regulated and remained constant up to 1997 followed by a slight decline, following the EU regulations. In addition, the decrease in the number of beach seiners for the years following 1997 is attributed to the fact that fishers have been subsidised for retreating their vessels (EU Reg 3699/93), because beach seiners are considered to be harmful for the stocks and habitats.

The increase in the HP/boat and GRT/boat ratios during 1964-2003 for all fisheries (Figures 3a and b), with the exception of the 'other coastal boats' fishery for which the rate of increase was much smoother, clearly indicates, when combined with the fact that the number of boats per fishery did not change considerably during that period (Figure 1), the modernisation of the Hellenic fishing fleet. For trawlers, the sharp increase in the HP/boat and GRT/boat ratios in 1988 is attributed to the fact that during 1985-1988 boat owners were subsidised by EU to modernise their boats (EU Reg. 4028/86). Also, such a modernisation brought about an increase in the fishers/boat ratio for trawlers during 1985-1997 (Figure 3c). This can be attributed partly to the aforementioned modernization but also to the fact that they operate on a 24 h basis, with increased personnel, exploiting various fishing grounds. Proportionate change was observed in the number of purse seiners, though at a steady rate. In contrast, for purse-seiners, the fishers/boat ratio is decreasing. This is attributed to the adoption of hydraulic winches and nylon nets, as opposed to cotton ones, until the end of the 1970s, whereas the increase at the end of the 1980s may be due to the replacement of older boats by new ones of higher capacity (larger tonnage and engine HP) due to EU subsidies (Figure 3c).

Despite the modernization of the Hellenic fisheries' sector and the fisheries' regulations currently enforced for pelagic and demersal fisheries (i.e. closed seasons, limited issue of new licenses, minimum legal landing sizes, mesh size regulations, banning of pelagic trawl, prohibiting the fishing of small pelagics with bottom trawl or with electric light (P.D. 244/21-6-91; EU Reg. 1626/94), increase of mesh size of codend in 40 mm stretched (EU Reg. 2550/2000)), fisheries' landings per effort are consistently declining. This fact reveals the inadequacy of the current management regulations, most of which are of technical and non-scientific practices (STERGIOU *et al.*, 1997). The situation gets more complicated due to multi-species and multi-gear nature of the fisheries which pose certain difficulties in using traditional fisheries models. New measures are thus required in order to complement the existing ones. One such measure is the adoption of marine protected areas (TSIKLIRAS & STERGIOU, this volume), which are also consistent with the current trends in fisheries management (i.e. ecosystem-based management: BROWMAN & STERGIOU, 2004).

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VI.1. ARTIFICIAL REEFS

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GENERAL OVERVIEW

Artificial reefs (A.R.) are an ancient invention, originating from the coastal regions of the Pacific Ocean. Even then, the observation of marine organisms gathering and flourishing in those primitive wooden structures resembling a reef was quite common. This old technique was rediscovered quite recently, about 40 years' ago. Second-hand industrial products such as vehicles, electric devices and other metallic constructions with complex surfaces were used in the dawn of artificial reef use. Nowadays, however, artificial reef are made of natural rocks, concrete or steel elements that aim to strengthen the bases of these sensitive natural marine ecosystems (Figure 1).

Productive artificial reefs aim to upgrade total fishing production and are seen to exist all around the globe. Among others, one of the main goals set in an attempt to establish an artificial reef include the improvement of fishing quantities of the targeted zones. There are obvious ecological advantages in their use, since the ecosystem is allowed to slowly build up by itself based on the morphological advantages of the artificial structures. Hence, these reefs are rightfully considered an important tool in the integrated management of the coastal environment.

Local areas and communities have much to profit from an artificial reef. The local ecosystems are enriched with young fish and the value of commercial stocks rises. The possible upgrade of local tourist activity due to these reefs must also be taken into account.

The main outcome of the well-being of an artificial reef is the increase of total biomass of the area through the attraction of more species of fish and more marine organisms. This results from the very attractive physical and biological conditions produced by these reefs that aim to minimize mortality of the species. The reefs are also responsible for upgrading the coastal ecosystems through the increase of local biodiversity. The decrease of the erosion caused by wave action in the coastal zone is also an important factor to outline and this is especially beneficial in highly eroded areas due to the construction of dams and other anthropogenic interventions.

When constructing an artificial reef, there are several factors related to the increase of fishing activity in the zone that should be examined.

Firstly, an artificial reef can alter the local distribution of biomass, abundance of fish or of any other commercial organism in the area near the reef. The increasing result in the indigenous fishing activities is directly due to the upgraded availability of the fish. However, in order to preserve the increasing trend in availability, it is imperative that a management plan is used in order to adjust the fishing efforts inside reef territory and thus, maintain species' availability. In order for management plans to be successful they should be integrated, taking into account sensitive factors such as socio-economics

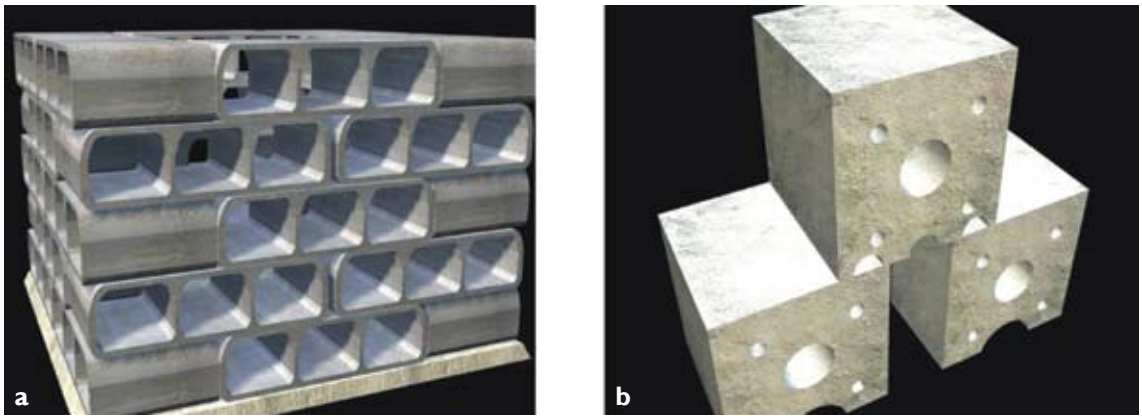

Figure 1: Artificial structures used in the pilot project at Fanari in the Thracian Sea. French (a) and Italian type (b) elements.

Figure 2: Species fished around the artificial reef of Fanari during the final phase of monitoring. The hard substratum species prevailed.

and other social problems, apart from the standard ecological and biological study that needs to be performed.

Secondly, the creation of a reef not only causes species massing in a defined area, but also increases the fished quantities. In this case, with the same fishing effort, there is far better efficiency. The increase of fished biomass is largely caused by the smaller natural mortality observed in the local fish populations since the artificial reef provides a safer and more sheltered environment. Combining the physical advantages of the reefs associated with their morphology, with the enrichment of certain fish species that are strategically chosen, results in even more positive results.

By a quick look through the relative international literature, examples of both of the above occasions can be found. Combining these reports with the scientific experience gained throughout the years, it can be easily concluded that artificial reefs can produce an outstanding result as far as fish production is concerned. The percentage reported in literature is usually around 5-20% from the total local fish production according to the type of the artificial reef being used (Figure 2).

However, there are some extreme examples that show a 400% increase. This increase is a result of many factors. For instance, the technical characteristics of the reef and the natural features of the selected area are very important. In many cases different building materials or altered structures create different results, attracting the relative species on each occasion. Also, increased fish production is observed mainly in areas with no natural reefs near the artificial environment. Areas with many natural obstacles, extensive rocky grounds, having unstable substrate or large inflow of floating material are judged as not suitable.

The main characteristics of the local fishing production have to be taken into account. A large number of factors is considered in each area in order to obtain the proper scientific knowledge in order to decide which species can be enriched by an artificial reef. Common species in the Mediterranean Sea are species of the family *Sparidae, Serranidae, Labridae, Scorpaenidae, Carangidae* and *Scombridae*.

Before the creation of an artificial reef, each part of the area would need to be examined oceanographically and biologically. The success of the reef depends largely on the study made by the performed studies.

Natural and artificial reefs should not co-exist, except in the case where there is a need to observe and make comparisons between them. Also since over-fishing can exterminate even the best yield results from an artificial reef, it is important to emphasize the importance of enforcing a management plan right after the reef is constructed to minimize time loss. The final receiver of the project's results should be the nearest coastal fishing association or cooperative who would have to take over its management. This partly ensures that the local communities keep their interests focused on the maintenance of the reef.

Both the Japanese and the Mediterranean experience on the artificial reef matter, shows the artificial reefs to be excellent tools in fisheries' management, allowing the management of the local fishing effort, differentiation of the fishing methods, new methods of aquaculture, management of the local biological resources and finally the increase in fish production.

ARTIFICIAL REEFS IN THE MEDITERANNEAN

During the 1960s in some areas of the Mediterranean, the first efforts of artificial reef construction were made by the sinking of crashed cars in areas with illegal fishing problems, but no scientific observations were performed. In 1974, the first scientifically designed artificial reef was set up in

the Adriatic Sea, by the Institute of Fisheries and Technology of Ancona (Italy), and consisted of 12 pyramids and 2 sunken boats (BOMBACE, 1981). In the years after, more artificial reefs were made in Italy, both in the Tyrrhenian and Adriatic Sea. In the Ligurian Sea, an artificial reef was completed between 1980 – 1985 in the Marconi Gulf (ORSI RELINI *et al.*, 1986). Relative actions took place also in Sicily in the Gulf of Castelamare.

In France, there have been many efforts for the construction of an artificial reef in Palavas (1968) skeletons of cars were used, old tyres and cube stones, giving a total of 400 cubic meters. In the beginning of 1980, in the Mediterranean Sea around Nice, 200 cubic meters of cube stones were used for the creation of another artificial reef. In Spain, during the last eight years many artificial reefs were built, aiming mainly for the protection of fishing from trawls. Today more than 50 artificial reefs exist all over the Spanish shores and at the same time, a management committee has been formed which watches over the newly constructed reefs as well as the progress of the older ones.

In Hellas the Fisheries' Research Institute (FRI), part of NAGREF, together with the former Institute of Marine Biology of Crete, participated for the first time in the construction of artificial reefs in 1997, when the Ministry of Agriculture issued a call for financial tenders, assigned to the consortium with the construction and monitoring of a pilot project aiming to demonstrate the utility of these structures for the coastal zone management. The reef was built by cube-shaped concrete blocks arranged in pyramids (ANTONIADOU *et al.*, 2001). The first problems encountered were mainly of a political nature since the long-term benefits of an artificial reef were difficult to explain to the local fishermen and the building costs were high (DOUNAS *et al.*, 2000).

The project commenced at the end of 1997 with the preliminary assessment which was focused in the marine area of Fanari in the prefecture of Rodopi. After approximately one year, in the middle of 1999, the construction of the artificial reef was completed with the laying of the artificial structures. The artificial reef is continuously being monitored since then by a number of scientific devices as well as by the specialized team of divers-biologists of the FRI who has undertaken the task of visual inspection.

The data that were being recorded comprised of the hydrographic characteristics of the area, the nutrients that are being accumulated or trapped by the artificial reef structures, the successive colonization of these structures by the large number of flora and fauna species, but mainly the colonization of the artificial reef by important species, commercial or not, of fish and invertebrates.

From the beginning of the artificial reef operation, immediately after the laying of the artificial reef structures, the divers team detected schools of fish which have begun to circulate around the artificial reef area, proving in this way that the fish, or at least some species of fish, instinctively are attracted by anything that differentiates the sea bottom offering them even elementary opportunities of sheltering and/or protection from predators.

Because the artificial reefs were laid in the middle of October, the first winter of monitoring passed without encouraging results, since the low temperatures in the area during the winter dissuade the dramatic colonization of the artificial reef by seaweeds and invertebrates, the presence of which is regarded as prerequisite for the attraction of fish who need them as a source of energy.

However, there were some species of fish like *Pagelus acarne* (axillary sea bream), that have settled there from the first day following the laying of the artificial reef, and have not abandoned it since leading us, after two years of monitoring, to record an increase of the species' presence by eight times in relation to the period before the construction of the artificial reef. This particular species has attracted other larger predators in the area, such as the *Seriola dumerili* (greater amberjack) which although they are not fished, they are recorded by the divers' visual inspection and the video recordings in equally increasing numbers.

Other species that colonized the area during the first spring following the laying of the artificial reef was *Diplodus vulgaris* (common two-banded sea bream), the abundance of which increased four times after a year of monitoring. *Trisopterus minutus capellanus* (poor cod) is another example. Its presence in the artificial reef was a surprise since it was believed until today that the species prefer to colonize in muddy environments. Other species for which a substantial increase was recorded were *Serranus scriba* (painted comber) which exhibited an increase of 700%, *Boops boops* (bogue), *Zeus faber* (John Dory), *Loligo vulgaris* (common squid), *Sepia officinalis* (common cuttlefish) and *Scorpaena* sp. (scorpion fish), with an recorded increase in their abundance that ranges between 100-500%. From the experimental samplings, a total of 101 species were recognized in the reef area, with 10 newly fished species (SOPHRONIDIS *et al.*, 2001). Seasonal differentiation in species' abundances was found to be present between seasons (KALLIANIOTIS *et al.*, 2003).

During the monitoring period and via laboratory analyses, it was discovered that the biocommunity of the area was gradually evolving and that a special substrata emerged on the artificial reef structures created by seaweeds, bivalves, ascidians and polychaetes in a continual succession of species and assemblages, an evolution process that is being continued until today.

The biological equilibrium in the rhythm of colonization was reached at the end of 2003, when the largest number of species was recorded since the construction of the artificial reef and the area that surrounds it. In 2005, the reef was observed to provide a steady basis for local fisheries, particularly for the species *Octopus vulgaris*, *Sepia officinalis*, *Penaeus kerathurus* and *Solea vulgaris* (ARGYRI & KALLIANIOTIS, 2005). The monitoring of the artificial reef continued until the end of 2004, five years after the laying of the artificial elements. At the end of the project the consortium proposed to the Regional Fisheries Office a management plan which focused on the future utilization of the artificial reef, not only for scientific purposes but for production purposes as well. This is considered to be the most difficult phase of the project, since the supervision of the area as well as the maintenance of the structures, have to be assigned to a private sector body, such as a fishing association.

In the area of the artificial reef, a prohibition of fishing activities has been issued from the beginning, that included all fishing gears, but in the future the specifications of the gears that are going to be used within the area of artificial reef, have to be described and included in the relevant management plan.

However, during and after the end of the monitoring phase we observed some negative phenomena mainly due to the gathering of a vast number of fishing vessels in the area, following the positive impression that the initial monitoring results gave, regarding the abundance of species in the artificial reef Despite the prohibition of fishing activities in and within two nautical miles radius around the artificial reef, many fishermen ignored it and were laying their fishing gears around the artificial reef and even sometimes inside the zone of absolute protection, where theoretically the environment has to be permanently left intact.

In the future, the artificial reef will attribute the best results only if its importance for the fisheries stocks as well as for the potential income for local fishermen, become comprehensible.

After 2002, FRI alone or jointly with HCMR has undertaken the feasibility studies of four additional artificial reef, namely in Kalymnos, in Ierissos, in Maliakos Bay, and that on the coasts of Pieria, while HCMR has undertaken the study of the artificial reef of Messolongi and Preveza. In any case, the consortium suggested the implementation of innovative technology, applying therefore, the experience gained from its participation in the realization of the first pilot plan in Fanari and the advances made by other teams abroad.

The artificial reefs are expected to play an important role in the management of the coastal zone in Hellas as is the case on a global scale, since they offer a steady point of reference in marine areas where it is difficult to appoint any element of ownership. In addition, they create an artificial ground for a combined concentration of marine species within a protected marine environment. With the enforcement of appropriate management, mixed systems of fishing and tourist activities of the areas as well as special forms of aquaculture can be applied and these can act in favour of small local communities which are still dependent on fisheries, and which for the benefit of our country should continue plying their traditional fishing activities.

CRITERIA FOR THE SELECTION OF SUITABLE AREAS

Suitable areas have to be chosen according to a clear methodology, examining various factors that will probably affect the project. For the selection of the installation position, it is necessary that areas with large trawling activities are excluded.

Among the most basic criteria that need to be taken into account are the substrate type, the sea depth, physical and chemical parameters, the existence of natural reefs, the protection of zones from over-fishing and others.

For the maximization of the biological development of the artificial reef, according to the preset goals, it is necessary to take into account the physical and chemical parameters of the selected area. With the fulfillment of the preliminary study the definition of the nature of the substrate as well as the hydrology of the water column must be carried out where the artificial reef will be installed.

ELEMENTS IN THE STUDY FOR THE CONSTRUCTION AND INSTALLMENT OF AN ARTIFICIAL REEF

For the proper and effective function of an artificial reef, the design would have to be based on biological, economical and mechanical demands, so that the suggested system would increase its productivity to the maximum fulfilling, at the same time, the goals of its manufacture.

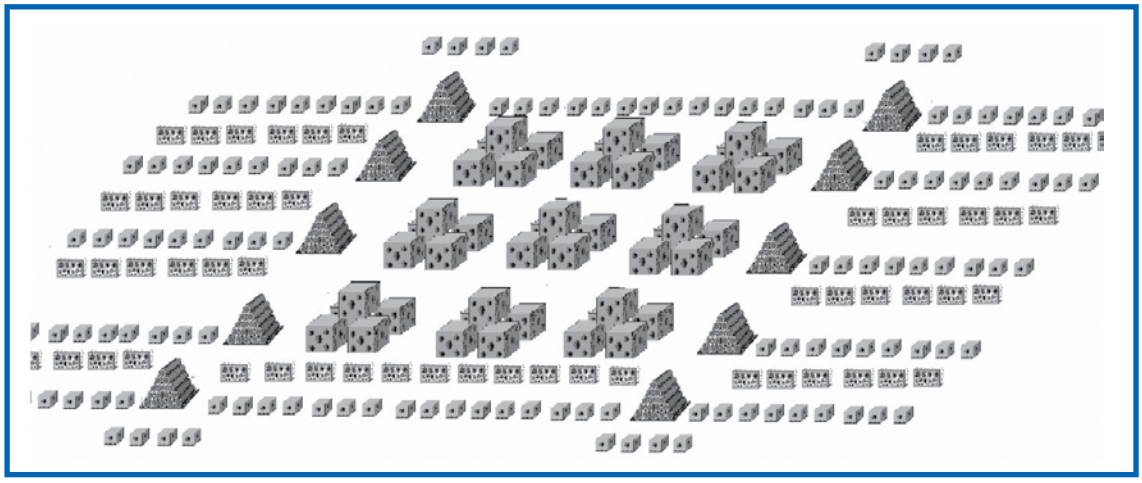

Figure 3: An artificial reef plan using four different types of elements, aiming to increase the complexity of the structure.

The artificial reef must be designed in a way to make food availability easier to both the transferring species and the species remaining settled in the surrounding zone. The various sections of the artificial reef must be formed in a way to help the feeding and settling of the more commercial species. The maximization of the population's abundance is the confirmation that the artificial reef was designed according to the special requirements of the "target" species or their habitat (Figure 3).

Apart from the evolution of its biological dimension, the artificial reef must be designed in a way to make possible tourist development in the zone. The amateur fisheries are usually directed to different species than the professional fishermen and as a result, this reef plan must be adjusted accordingly to take them into account as well. Also, the construction plan must be designed properly to prevent the damage of professional and amateur fishing equipment since many fishers will select the reef areas as their base.

The artificial reefs increase the attraction of fish, but also they can be designed to prevent trawl fishing and increase the fish production of these areas. The limitation or total ban of trawl fishing in an area surrounding an artificial reef, allows the strengthening of fishing with static gears and the increase of local fishermens' involvement.

MATERIALS USED FOR THE CONSTRUCTION OF ARTIFICIAL REEFS

European and Japanese scientists are leaders in the research of the study of structural material used in the construction of artificial reefs and the use of concrete has become more widely accepted by European manufacturers. The most common block used is made of concrete; it can be cubic or cylindrical with round or triangular openings. The use of second-hand materials for the construction of artificial reefs has obvious economical significance but the impact on the environment should be carefully evaluated.

The use of old tyres for the construction of artificial reefs has provoked many discussions and many different opinions have been given about the issue. The common opinion in Europe is that these materials are thought to carry dangerous toxic substances during their time in the sea and for this reason their use is not seen as positive.

Shipwrecks are often suggested for artificial reefs and also for scuba-diving activities. In the United States 80% of the underwater A.R. (MC GURRIN, 1989) are comprised almost exclusively of shipwrecks or other second-hand industrial construction materials. Yet, no research has been made on the suitability of shipwrecks for artificial reef areas and thus their proper value remains unknown. Old boats should be carefully cleaned of all harmful material such as copper and remaining fuel before their use. It is important to point out that wooden fishing boats are considered unsuitable as far as the shallow water areas of the artificial reefs are concerned, since the chances of them being crushed by strong wave activity are high.

EVALUATION OF THE ARTICICIAL REEF EFFICIENCY

There are two basic problems when starting preparations for a commercial-use artificial reef. The first concerns the time at which the artificial reef will be ready for fishing activities; secondly, the determination of maximum fishing effort and the rel-

Figure 4: Colonization of the artificial reef in Fanari. Large crustaceans have created their shelter at the base, while other species used the flat areas.

Figure 5: Position of existing and programmed artificial reefs in the Hellenic Seas.

evant constant fish production of the artificial reef. These issues cannot be answered initially, in areas where no artificial reef has been constructed in the past. They can be answered during the second phase of construction, a phase that co-exists with the scientific and technical monitoring of the artificial reef.

It is difficult to calculate the fish production an artificial reef can produce, because this depends on the nature of the management plan that will be enforced.

The observation of fishing exploitation is done with experimental fishing. This type of fishing has to be constant from the beginning of installation of the A.R, so that it can be related to the trends of fishing indicators present, and to quantify the influence of commercial fishing inside the artificial reef area. The artificial reef projects serve also management purposes by making the creation of marine protected areas possible.

Future research regarding artificial reefs should focus on the importance of the surrounding habitat, reef size and the seasonality of certain factors such as the improving of recruitment, the growth of juvenile fish and spawning success. Still, the optimization of the design is a priority. More effective block styles would have to be discovered and the cost-effectiveness of the structures improved.

Other than that, apart from preventing trawling, the importance of predation and shelter on early species' recruitment would have to be evaluated carefully in each case (Figure 4). Proper shelter provided by the artificial reef complexity can decrease predation and thus help the stability of fish populations in the area. The distance between reef blocks is also important since structures with the same complexity have different fish assemblages depending on how far they are from each other. Finally, standard methods of monitoring are needed to help gather concrete evidence on the artificial reef success and give the project a solid statistical certainty.

The artificial reef in the Thracian Sea was a pilot project, aiming at monitoring the effects on the environment and also the impact on local fisheries. The Hellenic National plan for the artificial reef included the creation of three more reefs, in Ierissos Bay, in Kalimnos and in Preveza. At present,

new projects are being planned in order to start the construction of more artificial reefs., for example, on the coast of Pieria, in Mesolonghi and the Gulf of Kavala (Figure 5).

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Ο Δρ. Κ.Παπακωνσταντίνου είναι Διευθυντής του Ινστιτούτου Θαλασσίων Βιολογικών Πόρων του Εθνικού Κέντρου Θαλασσίων Ερευνών και μέλος του Διοικητικού Συμβουλίου του. Γεννήθηκε στη Λάρισα το 1946 και αποφοίτησε από το Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης, Τμήμα Φυσιογνωστικό το 1969. Αναγορεύθηκε διδάκτορας των Βιολογικών Επιστημών από το Πανεπιστήμιο της Αθήνας το 1975. Εξειδικεύθηκε στην Ιχθυολογία και Αλιεία στην Ιταλία, Μ. Βρεττανία και ΗΠΑ και από το 1975 είναι ερευνητής στο Εθνικό Κέντρο Θαλασσίων Ερευνών. Εξελέγη Δ/ντής του Ινστιτούτου Θαλασσίων Βιολογικών Πόρων πρώτη φορά το 1989. Ο Δρ. Κ.Παπακωνσταντίνου ασχολείται με την αλιευτική βιολογία, τη δυναμική και την αλιευτική διαχείριση των ιχθυοπληθυσμών των ελληνικών θαλασσών και γενικότερα της Μεσογείου Θάλασσας. Έχει δημοσιεύσει 90 περίπου επιστημονικές εργασίες σε διεθνή επιστημονικά περιοδικά, περισσότερες από 180 ανακοινώσεις σε διεθνή και ελληνικά επιστημονικά συνέδρια, μεγάλο αριθμό άρθρων σε περιοδικά και εφημερίδες και έχει συγγράψει 7 βιβλία. Έχει συντάξει και διευθύνει μεγάλο αριθμό διεθνών και εθνικών ερευνητικών προγραμμάτων τα οποία έχουν χρηματοδοτηθεί από διεθνείς και εθνικούς φορείς. Έχει διδάξει ιχθυολογία, δυναμική ιχθυοπληθυσμών και αλιεία ως επισκέπτης καθηγητής στο Πανεπιστήμιο του Μπάρι (Ιταλία), Γεωπονικό Πανεπιστήμιο Αθηνών, Πανεπιστήμιο Θεσσαλίας, Πανεπιστήμιο Κρήτης και Πανεπιστήμιο Αιγαίου. Έχει διατελέσει επί σειρά ετών πρόεδρος Επιτροπών Διεθνών Οργανισμών (CIESM), μέλος Διεθνών και Εθνικών Επιτροπών σχετικών με την αλιεία και διαχείριση των αλιευτικών πόρων της Μεσογείου και έχει αντιπροσωπεύσει τη χώρα σε πολλά διεθνή Συνέδρια και Οργανισμούς. Έχει οργανώσει σημαντικό αριθμό Διεθνών και Εθνικών Συνεδρίων με θέματα σχετικά με την αλιεία και την αλιευτική διαχείριση. Είναι μέλος διεθνών και εθνικών ερευνητικών εταιρειών που δραστηριοποιούνται στην ιχθυολογία, αλιεία, διαχείριση και προστασία των θαλασσίων βιολογικών πόρων.

Dr C. Papaconstantinou is the Director of the Institute of Marine Biological Resources of the National Centre of Marine Research and member of the Board of Directors. He was born in Larissa (Greece) in 1946 and graduated from the Aristotelian University of Thessalonica, Department of Natural Resources in 1969. He received his PhD from the University of Athens in 1975. He specialized in Ichthyology and Fisheries in Italy, UK and USA and since 1975 he is a researcher in the National Centre for Marine Research. He was appointed Director of the Institute of Marine Biological Resources for the first time in 1989. His field of interest is the biology, dynamics and management of fish populations of Greek seas and Mediterranean. He has published more than 90 scientific papers in international scientific journals, has participated with more than 180 presentations in international and Greek scientific conferences, has written a large number of articles in periodicals and newspapers and is the author of 7 books. He has organized and directed a large number of international and national research projects, which have been financed by international and national institutions. He gave lectures on Ichthyology, Dynamics of fish populations and Fishery as a visitor professor in the University of Bari (Italy), Agronomic University of Athens, University of Thessalia, University of Crete and University of the Aegean. He has been chairman of the Committee of Living Resources of the CIESM (1996-2001), member of International and National Committees related to the fishery and management of fisheries resources of the Mediterranean and has represented Greece in numerous International Congresses and Organizations. He has organized a significant number of International and National Conferences related to fishery and fisheries management. He is member of numerous international and national research societies that are working in the field of ichthyology, fishery, management and conservation of marine biological resources.

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